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WEAPON SYSTEM WARRANTIES: AN EXAMINATION OF THEIR ADMINISTRATION WITHIN THE DOD

THESIS

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THESIS

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Timothy C. Ceteras

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Abstract

Warranties are required by law to be obtained on all weapon systems purchased by the Department of Defense. As a result, the three services within the DoD must face a variety of issues associated with weapon system warranties. This thesis examines the issues associated with the acquisition, enforcement, and subsequent evaluation of warranties. It then examines how each of the three services treat these issues in their supplement to the Federal Acquisition Regulation and in their primary warranty regulation.

Prior to examining the foregoing issues, the thesis begins by first reviewing the background of warranties and discussing some theoretical considerations. The issues themselves are then presented followed by their treatment by the DoD. After the examination of the issues and their treatment by the DoD, recommendations are made for suggested improvements to the services' regulations. This thesis is useful in that it identifies several areas that should be addressed by the military departments in their warranty guidance. It also advances recommendations for improvements to the regulations.

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I. INTRODUCTION

General Issue

Expenditures for new weapon systems in the Department of Defense (DoD) have increased significantly in the past several years. Additionally, the entire procurement process has come under close scrutiny and is frequently criticized by both the public and their elected legislative officials. In what appears to be an attempt both to curb a weapon system's escalating life-cycle costs and to improve its quality and reliability, Congress has required through legislation that major weapon systems come with a written warranty from the manufacturer. Warranties are now one more issue that must be considered in the long, complicated and involved acquisition process.

In order to be effective and consistent with the warranty laws, it seems natural to expect warranties to be acquired, administered, and evaluated in a like or similar manner throughout the DoD. (All acronyms used in this thesis are listed in the Appendix at the end). The Federal Acquisition Regulation (FAR) and the Defense Federal Acquisition Regulation Supplement (DFARS) form a starting point by providing basic warranty guidance and by prescribing clauses that may be included in solicitations and resultant contracts. However, each agency within the DoD has separate regulations that it follows regarding warranties. Accordingly, approaches to acquiring warranties may differ, prices for similar

valuable information may not be available to the other services as a result of potentially inadequate data collection and storage.

This thesis looks at the issues involved in the analysis and administration of warranties with a specific focus on the aspects of warranty acquisition, enforcement, and evaluation within the DoD. The treatment of these issues by each service's regulations and governing directives is examined with proposed recommendations for improvement advanced and discussed.

Warranty Background

Before examining the foregoing issues in any detail, a brief review of warranties and the definition of several terms is in order. Additionally, different types of warranties will be reviewed followed by a short discussion on their legislative requirements. A brief look at why warranties are used in general and in the DoD will complete this portion of the thesis. This will familiarize the reader with warranties in general and provide a common foundation for the concept of warranties and other terms as they are used throughout this thesis.

Almost everyone is familiar with a warranty in some form or fashion. Most individuals associate a warranty as a promise from a manufacturer that its product will work for a prescribed period of time in a satisfactory manner or the manufacturer will provide the purchaser some form of remedy, such as repairing or replacing the item. The FAR formally defines a warranty as:

> A promise or affirmation given by a contractor to the Government regarding the nature, usefulness, or condition of the supplies or services furnished under the contract. (25:Part 46.701)

Warranties are also known by other terms such as guarantees or as product performance agreements. While sometimes used interchangeably with warranties, a product performance agreement can be defined as:

> a form of warranty, guarantee, or incentive used in a Government contract to achieve or improve product performance or supportability in the operational environment. (7:Par 1j)

Other terms that the reader should be familiar with are:

> "Cost-Benefit Analysis" is an analytical tool used to determine if a warranty is cost effective by analyzing both the qualitative and quantitative costs and benefits of the warranty. (7:Para 1b)
>
> "Weapon System" is an item that can be used directly by the Armed Forces to carry out combat missions and that costs $100,000 plus or for which the eventual procurement is $10 million plus. It does not include commercial items sold in substantial quantities to the general public. (7:Para 1o, 20:83)
>
> "Essential Performance Requirements" are the operating capabilities and/or maintenance and reliability characteristics of a weapon system that are determined by the Secretary of Defense (or delegated authority) to be necessary for it to fulfill the military requirement for which the system is designed. (7:Para 1e)

Having defined a warranty and related terms, the next step is to break down warranties in general into types and classifications.

Warranty Types

There are two basic types of warranties recognized and in general use today. These are implied warranties and express warranties. An implied warranty is established when an item is sold for its intended purpose and such purpose is known and understood by both parties involved in the transaction. An express warranty, on the other hand, is one that specifically states that the item conforms to a set of specifications or a product description. It also enumerates what remedies the manufacturer will provide if the item does not conform (15:3). The type of warranty addressed in this thesis is the express warranty.

Express warranties obtained by the DoD can be further divided into two general categories or classifications. These are specification warranties and performance warranties.

Specification Warranties. Two types of warranties belong in this category. The first type are design and manufacturing warranties. These warrant that the items produced conform to the design requirements specifically delineated in the production contract (1:6, 23:4). The second type of specification warranties are material and workmanship warranties. These warranties "generally state that if something breaks during a specified period due to defective material and workmanship which existed at the time of delivery, the manufacturer will repair or replace it at no additional cost to the government" (1:6).

Performance Warranties. This category includes warranties that require the items furnished under the contract to conform to the performance requirements as specified in the production contract (1:6). Stucker and Smith break this category down further into two sub-categories, availability and functional. They define availability as "the overall reliability and maintainability characteristics of the system (how long a weapon will operate at a satisfactory level and how difficult a weapon is to fix), usually expressed as a probability or a percentage" (23:8). Functional performance is defined as "how well the system functions as intended: missile accuracy, aircraft speed, etc" (23:8). The types of warranties expressly required by 10 U.S.C. 2403 and DFARS Subpart 46.7 are design and manufacturing warranties, materials and workmanship warranties, and performance warranties.

Warranty Requirements

Early Usage in the DoD. Warranties have been included in defense procurement for years. In 1964, guidance on using warranties in firm-fixed price contracts was issued by the DoD. In 1967, warranty coverage was expanded with the introduction of a warranty for construction (16:25). However, in 1971,

the DoD hoped to reduce its escalating costs of defense contracts and changed its policy. It then became "... the policy of the Department of Defense to generally act as self-insurer for loss of or damage to property of the government occurring after final acceptance of supplies delivered to the government and resulting from any deficiencies in such supplies" (16:25-26). In 1980, the Air Force issued the first Product Performance Agreement Guide that summarized warranties and their potential applications. The Product Performance Agreement Center (PPAC) was established in 1982 to provide a focal point for warranty use in the Air Force. The Carlucci Initiatives in 1982 listed warranties as a potential way to improve reliability and maintainability of weapon systems purchased by the DoD (2:2-2). However, regulatory guidance appeared to be inadequate in the eyes of the Congress.

Legislative Requirements. Warranties are common in today's commercial market. Most products purchased today carry some type of warranty or limited warranty. Even North Dakota Senator Mark Andrews' farm tractor came with a warranty (4:143). It seemed natural then to Senator Andrews that since consumers obtained warranties on their purchases, so should the Pentagon. This prompted Senator Andrews to add an amendment to the 1984 DoD Appropriations Act that required weapon systems purchased by the DoD to come with a warranty (4:143). Thus, Public Law 98-212, Section 794, (also referred to as the Andrews Amendment) became the first law requiring warranties in DoD procurement. The law is fairly brief. Basically, it requires all weapon systems purchased with appropriated funds to come with a written guarantee that the system will work as designed, that the system is free from defects, and that the prime contractor will repair or replace the system if defects are noted. The Andrews Amendment did make allowances for the granting of

waivers when such waivers would be in the interests of national defense or when a warranty would not be cost effective. When the requirement is to be waived, the law required written notification to congressional committees (24:1454-1455).

In his 1986 Naval Postgraduate School thesis, Lieutenant Kevin L. White notes that the new warranty law raised complaints from both the DoD and industry. These complaints "ranged from excessive warranty costs to severe problems of warranty administration" (27:25). Consequently, new legislation was drafted in response. The Defense Procurement Reform Act, Public Law 98-525, established Title 10, Section 2403 of the United States Code. Entitled "Major Weapon Systems: Contractor Guarantees", this new law was aimed at resolving the issues raised by P.L. 98-212. In their 1985 Air Force Institute of Technology thesis, Captains Hernandez and Daney noted that "there is little difference between P.L. 98-212 and P.L. 98-525 except P.L. 98-525 did refine and narrow the scope of P.L. 98-212 and redefined some key terms (18:45). Ken Jackson writes in Contract Management that P.L. 98-525 changed the Andrews Amendment in the following six ways:

> The definition of "weapon system" and "component" were changed
>
> The Secretary of Defense or his designate can choose between the stated remedies for breach of warranty unless otherwise provided in the contract
>
> Language was added that clearly authorized the negotiation of specific details of a guaranty including reasonable exclusions, limitations, and duration
>
> The Secretary is empowered to reduce the price of any contract to collect the reasonable costs of corrective action undertaken by the U.S.
>
> The guaranty requirement applies only to systems that are in mature full-scale production. This means that it applies to all units after the first one-tenth of the eventual total production or the initial production quantity, whichever is less
>
> The warranty also applies to any design or manufacturing requirement included in a contract amendment. (19:13)

DoD Requirements. The implementing directive of the new warranty law in the Department of Defense is contained in the Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 46.7. This subpart sets forth DoD policy and procedures for obtaining warranties pursuant to 10 U.S.C. 2403, defines terms incidental to warranties, discusses the subject of cost-benefit analysis and sets forth the procedures for requesting waivers. Essentially, DFARS 46.7 mandates the use of warranties unless they are shown not to be cost effective. A more extensive examination of this portion of the DFARS will be conducted in Chapter 3. The implementing directives and regulations of the separate services will also be addressed later in this thesis.

Reasons For Using Warranties

Warranties are used in both the commercial sector and the military for a variety of reasons. One of the main reasons for the warranty legislation appears to have been to improve the quality of the weapon systems purchased by the DoD. Indeed, many sources agree that by requiring warranties, contractors will provide higher quality, more reliable systems (16:28, 21:9, 26:37). Fortune magazine quotes an aide of Senator Andrews as saying:

> Our objective is to make sure the weapon works right the first time. If it doesn't, the manufacturer has to fix it and the taxpayer stops footing the bill. (4:143)

According to Stucker and Smith, "the objective of a weapon warranty generally should be to improve the probability that the system will perform at a specified, acceptable level when it is needed" (23:3). Stucker explains that a fighter pilot needs a warranty that will raise his confidence that his aircraft will perform when he needs it to perform. Accordingly, this achievement of specified

performance levels helps to instill confidence in the system by the user in the field. Stucker also notes that warranties can be used to improve efficiency and to shift risk from the buyer to the seller (23:17). Efficiency can be improved by reducing life-cycle costs, reducing support costs and by concentrating on the requirements of the system early (the design stage) rather than later when corrective action is much more expensive (23:18). By shifting the risk from the buyer to the seller, the seller is incentivized to improve its product and to manufacture it and support it more efficiently (23:19). This shifting of risk is what Stucker and Smith refer to as the insurance aspect of warranties. It seems that the main reason warranties are purchased in the DoD is to initially provide a quality weapon that is reliable more so than to provide for subsequent repairs as failures occur.

Plan of This Thesis

The purpose of this research effort is to address the administrative problems associated with the acquisition, enforcement, and subsequent evaluation of warranties within the US Air Force, US Army, and US Navy. An analysis and comparison of each services's primary warranty regulation and supplement to the Federal Acquisition Regulation, relative to weapon system warranties, will be accomplished and recommendations for improvement will be made. Chapter 2 will examine some of the issues in the analysis and administration of warranties. After an overview of these issues, Chapter 3 looks at the acquisition aspects of warranties in each of the three services. Chapter 4 will examine the enforcement aspects and Chapter 5 the evaluation aspects for

each service. Chapter 6 will conclude the thesis by presenting the summary, conclusions, and make recommendations for possible improvements.

II. Issues in the Analysis and Administration of Warranties

The previous chapter provided a brief review of warranties and background information on their required use in the Department of Defense. The purpose of this chapter is to consider issues relating to the acquisition, enforcement, and subsequent evaluation of warranties with the intent being to highlight those worthy of regulatory coverage by each agency within the DoD. Having done so, chapters three, four, and five will examine how each branch of service within the DoD covers each issue in its primary warranty regulation and agency supplement to the Federal Acquisition Regulation.

Acquisition Issues in Warranty Administration

The purpose of this thesis is not to consider the issues involved in deciding whether or not a particular warranty should be purchased. Rather, the research in this thesis involves the comparison of the governing directives for each service, and how they address the administrative issues associated with the acquisition, enforcement, and evaluation of warranties.

The acquisition aspect of warranties involves issues such as who will be responsible to purchase the warranty, why a warranty should be purchased and the purpose it will serve, the benefits and the costs associated with the warranty, what should be done when a warranty is determined to not be cost-effective, what the price of a warranty should be, the coverage and duration of warranties, the identification of a warranted system and related items, failures, exclusions and possible funding considerations.

Buying Responsibility. With regard to the administration of warranties within the DoD, one of the more important issues is the identification of those who will

be responsible for purchasing the warranty. It would seem natural to expect that those who buy the system, will also buy the warranty. The acquisition of a weapon system is a long, complicated, and demanding process requiring inputs from many areas of expertise. In the acquisition phase of a system, the desired levels of performance and availability are being determined and formulated. These must then be articulated clearly and effectively to the manufacturer, including the warranty requirements. Accordingly, obtaining the warranty on the system should also involve inputs, advice and coordination from various functional experts. Thus, one such method to acquire effective warranties may be through the unified team approach, with input solicited from individuals in engineering, contracting, quality assurance, legal, and the ultimate user of the proposed system. Therefore, to assure a balance in warranty acquisition responsibilities is achieved, warranty regulations should address the issue of warranty acquisition responsibility and advocate the team approach.

Reasons For Buying Warranties. A brief review of the reasons why warranties are purchased will provide a framework to consider when discussing the acquisition aspect of warranties. The Federal Acquisition Regulation states that a warranty should "(1) delineate the rights and obligations of the contractor and the Government for defective items and services and (2) to foster quality performance" (25:Subpart 46.702(a)). There appears then to be two reasons why a warranty should be purchased.

First, as mentioned in Chapter I, warranties act as a type of insurance for the buyer. This insurance aspect is more relevant however to the individual consumer than it is to a large industrial organization such as the DoD. Individual consumers typically tend to avoid risk, and hence purchase warranties as well as other types of insurance as a hedge against catastrophic losses. Large scale

industrial activities however are able to pool the risks of their individual members. This results in a much smaller chance of a proportional catastrophic loss. Accordingly, it is usually recommended that large scale activities, including the DoD, act as a self-insurer (15:2).

Additionally, warranties enhance the value of the item, tend to improve its reliability and availability, and increase the users' confidence in the system. It's this assurance aspect of warranties that holds the most promise for the DoD. Research in this area seems to indicate that the real reason for warranties in the DoD is to ensure that the system works for the user in the field, and that it delivers and performs as agreed to by the manufacturer. This assurance realization benefit can be more easily conceptualized by the introduction of a warranty cost-benefit model. This model will also provide a better understanding of the cost-benefit concept itself. This is important in that the warranty law and DoD policy require that only cost effective warranties be purchased by the DoD.

Warranty Cost-Benefit Model. Dr. Leroy Gill's paper, "Evaluating the Benefits and Costs of DoD Warranties" provides an excellent discussion on this topic and will be used extensively throughout the discussion.

In a negotiated procurement, once unit price, quantity, and the level of warranty coverage (reliability) to be provided are agreed upon, total revenue in effect has also been determined. Thus, profit maximization for the firm will occur where the specified quantity is produced at minimum cost. Dr. Gill's model shows the warranty effect on a manufacturer's total cost and is displayed graphically in Figure 1 (15:9).

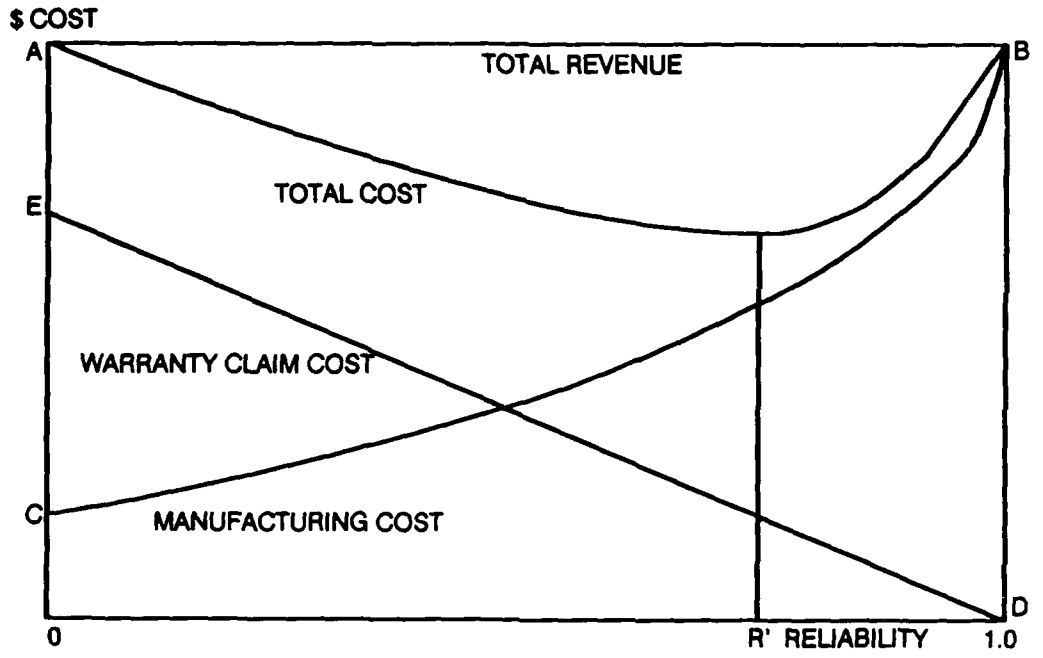

Figure 1. The Manufacturer's Total Cost Curve (15:9)

Figure 1 graphically represents (for a predetermined fixed number of units) the manufacturer's total costs when warranty cost are considered (15:8). Total revenue is assumed to be predetermined and remains constant. The height of this horizontal line is contingent upon the result of the negotiations between the buyer and the manufacturer. The warranty claim cost is a straight downward sloping line, representing the penalty incurred by the manufacturer for each failure. This is calculated by multiplying the penalty times the quantity failed. If no units fail, the manufacturer's costs are zero and are represented by point D in Figure 1. If every unit failed, its costs would be point E. Since the quantity to be produced has been predetermined prior to the manufacturing process starting, it follows then that the manufacturing costs increase at an increasing rate, due to the increased costs of improved reliability. Total costs are determined by adding

vertically the warranty claim costs and the manufacturing cost curves. Thus, the manufacturer's profit is maximized at the point where the total cost curve is lowest. In Figure 1, this point of minimum cost, maximum profit, and delivered reliability is depicted by point R' on the horizontal axis (15:8-10).

An examination of Figure 2 shows the effects of increased warranty coverage.

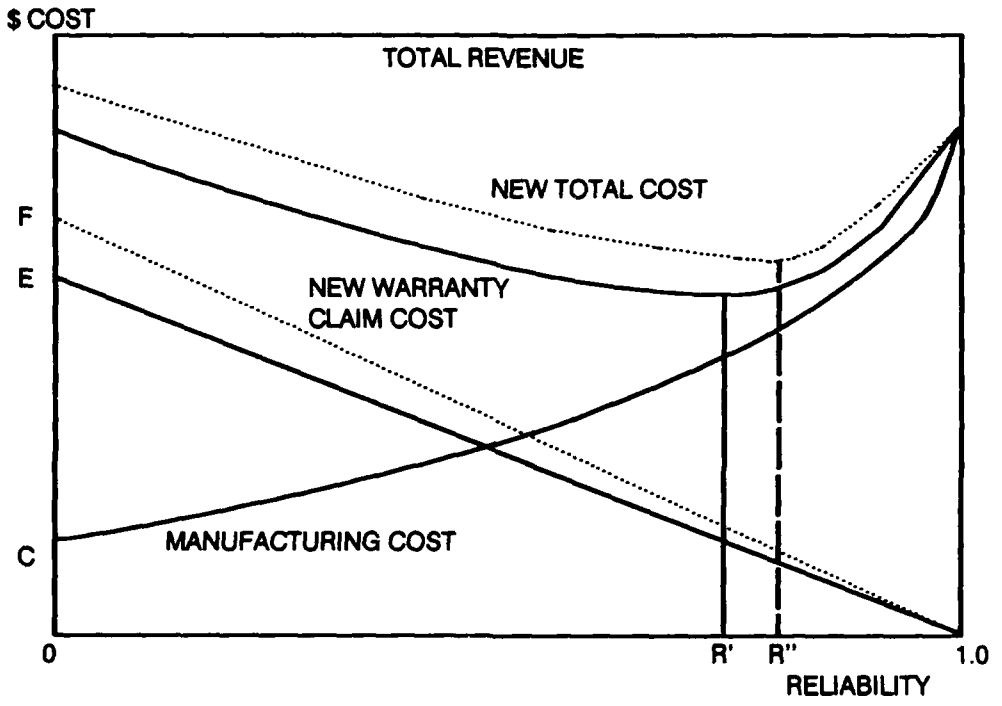

Figure 2. Warranty Induced Changes in Reliability and Costs (15:14)

As warranty coverage is increased, the cost per failure increases. Consequently, the warranty claim cost line now becomes steeper. While no change in the manufacturing cost curve occurs, the total cost curve increases due to the increase in the warranty claim cost line. Again, to achieve maximum profits, the manufacturer will provide output at that point where the total cost curve is at its lowest point. This corresponds to point R" on the horizontal axis, indicating an increase in delivered reliability (15:13-15).

Thus, when warranty coverage is increased, the reliability of the warranted system also increases. Analyzing Figures 1 and 2 leads one to the conclusion that to achieve maximum profits, the manufacturer will produce at the point where its total cost curve is at its lowest point. By requiring the manufacturer to provide a warranty, there is an incentive to produce more reliable products in order to minimize its warranty claim costs, thus minimizing its total costs.

Benefits of Warranties. The benefits of warranties to the DoD can best be described by the effects they have on mission performance (15:16). As shown previously by the two models, economic theory says that warranties will ultimately increase the system's reliability. This increased reliability should in turn eventually result in improvements in performance, maintainability and quality, thus enhancing mission support and mission accomplishment. In order to measure and quantify changes in reliability, the levels of reliability both before and after the warranty must be known.

Cost savings are often confused as being a benefit. However, they are not a benefit but are originally accounted for when the costs of each proposed alternative are being considered. Thus a cost savings merely reduces the ultimate cost of whichever option is under consideration. The actual benefit to be derived results from the services the weapon system produces (15:16).

Costs of Warranties. The costs to be reviewed here are from the buyer's perspective. These are explicit costs and implicit costs.

Explicit Costs. These costs represent the "out of pocket" costs incurred by the buyer. In the DoD, these costs would be the actual costs directly attributable to the increased reliability or performance required by the warranty provisions. Or simply stated, the costs the contractor charges because of the warranty.

These costs are shown in the model as the manufacturer's total costs for a particular warranty level, or level of reliability, plus the manufacturer's profit.

Implicit Costs. These are the costs that can't be easily counted nor assigned. They typically represent administrative overhead costs incurred as a result of actions taken by the buyer in obtaining the warranty. These costs include writing and evaluating the warranty requirements, keeping track of warranty actions (failures and resultant remedies), enforcing warranty claims, required training associated with warranties, and other similar costs. These costs are not only difficult to measure, but often become clouded when warranty benefits such as reduced maintenance requirements, lower inventory costs and similar "implicit" savings are realized by the buyer.

This brief discussion on benefits and costs was necessary in that the warranty law and DoD policy require that only cost effective warranties be purchased by the DoD. Accordingly, some type of cost-benefit analysis must be conducted in order to determine the cost effectiveness of the proposed warranty. Its importance lies in that in order to appropriately conduct this cost-benefit analysis, an understanding of costs and benefits is required. Additionally, completing a thorough and accurate cost-benefit analysis will enhance the contract negotiator's position during contract price negotiations.

However, cost-benefit analyses are not always accomplished. A study released by the GAO in July 1987 found that of the 97 contracts they reviewed that contained warranty provisions, only nine included a cost-benefit analysis confirming that the warranty was cost effective (14:24). Therefore, agency regulations on warranties should include the requirement of conducting a cost-benefit analysis, confirming that the warranties are indeed cost effective.

Waiver Procedures. When the required cost-benefit analysis shows however that the warranty is in fact not cost-effective, the DoD FAR Supplement requires each agency to issue procedures for processing waivers. As a minimum, the procedures require:

1. A brief description of the weapon system and its stage of production;

2. The specific warranty or warranties required by 46.770-2(a)(1) for which the waiver is requested, the duration of the waiver if it is to go beyond the instant contract and rationale for the waiver; and,

3. A description of the warranties or other techniques to be employed to assure acceptable field performance of the weapon system. (5:Subpart 46.770-9 (d)(1))

Accordingly, the upcoming review of agency regulations will include verification of the foregoing requirement.

Warranty Prices. Based upon the foregoing discussion, it seems then that the price of a warranty should not be more than the difference between the benefits a warranty provides and the cost of the warranty itself. Although this approach is somewhat simplistic, herein lies the problem of determining the accurate price of a weapon system warranty. As mentioned in the discussion of warranty benefits, reliability levels both before and after the warranty must be known in order to measure any increase. Additionally, the costs incurred by the buyer, both implicit and explicit, also need to be quantified in order to make a meaningful comparison between the two. The ability to capture such information would greatly enhance the ability of the contract negotiator in obtaining a fair and reasonable price for the warranty. Ultimately, the price paid for the warranty will be an agreement as to what the buyer is willing to pay and what the seller is willing to accept. The GAO found that the DoD paid an average of 1.4 percent of the contract price for its warranties (14:19). While this is an interesting observation, future warranty prices should not be based only upon a percentage

range of previous warranty prices. Arbitrarily deciding on a price for the weapon system warranty could result in the contractor receiving profits greater than required to secure the acceptance of the contract. Thus, warranty pricing is an important issue that should be considered.

As such, warranty regulations should provide those working with warranties a basis for estimating and or developing a concept of warranty benefits and costs. At the very least, the regulations should reference other guidance in conducting such analyses and provide general guidelines when formulating warranty pricing arrangements. A point of reference may be the simplified price analysis procedure presented in the Warranty Handbook published by the Defense Systems Management College (2:7-4).

Warranty Coverage. When acquiring warranty coverage, the extent and duration of the warranty are important issues that must be considered. It should be determined early whether a complete system warranty should be obtained or whether sub-system warranties or separate component warranties will be acquired. These considerations are important due to the effects of other programs such as component breakout and dual-sourcing.

Breakouts have been known to provide significant cost savings to the procuring activity due to the increased competition and are used extensively within the government. However, breakouts may be hampered or even prohibited by warranties due to such factors as isolating the fault of failures, determining responsibility for failures, or pinpointing manufacturing liability. When requiring warranties, these tradeoffs must be considered and such topics addressed in the contract to preclude a loss of cost savings to the government. Warranty regulations should guide the user in this important area.

Warranty Durations. An associated consideration of warranty coverage is the duration of the warranty. Depending upon the system, the duration of the warranty can have far reaching effects in terms of administrative burdens and difficulties, future system replacement considerations, etc. When considering warranty durations, the first factor to consider is when the warranty coverage begins. The effective start date of the warranty could be when the item is delivered to the user, or another time-table such as the completion of acceptance testing. On the other hand, warranty coverage could begin at a set calendar date that is mutually agreed to by both parties.

The second factor to consider is the basis for measuring the duration of the warranty. The warranty period may be defined as a set number of calendar days or operating hours depending upon the system. For example, the system may be warranted for 90 calendar days after acceptance or 200 operating hours of normal use. Warranty regulations should guide the user in the areas of warranty coverage and duration to ensure effective and appropriate warranty coverage is obtained.

Warranty Identification. To ensure that the benefits of warranties are realized and that unnecessary costs are not incurred, warranted items (including total systems) should be clearly marked as being under warranty. This will help to ensure that warranties are not voided unknowingly by the users and that appropriate warranty claims are filed. The GAO found that of the 97 contracts they reviewed, only 23 required physically identifying the warranted item as one of the contractual provisions (14:30). Warranty regulations should include the requirement that warranted items and systems be properly marked and identified.

Failures and Remedies. When considering warranty coverage and determining warranty requirements, careful consideration should be given to the

subject of failures and remedies. A failure as used in the model is an event for which the manufacturer is responsible for correcting. It can mean such things as a complete inability of the item or system to perform its required task or its inability to achieve a contractually required level of performance. In any event, clear and precise performance requirements appear to be essential in order to determine when in fact a failure has occurred. Toward this end, accurate means of measuring and evaluating performance, reliability, availability, etc should exist to make such determinations possible. Having determined that a failure has occurred and warranty coverage is applicable, documentation of the failure and corrective action is the next element of consideration.

Warranty regulations should establish documentation requirements and the level of effort necessary to substantiate system failures. In addition, the type and extent of available remedies should be addressed in the warranty regulations in addition to being set forth in the contract itself. Remedies include repair and replacement of the item, redesign of the entire family of items when necessary, and an adjustment in the contract price when other remedies are not practical or possible (2:3-9,10).

Exclusions. Obviously, a manufacturer can not be responsible for circumstances resulting from events or forces outside its control. Accordingly, exclusions would be reasonable and should be included in the contract. Warranty regulations should guide those in formulating warranty terms and conditions as to the extent of the manufacturer's obligations and what it should and should not be responsible for. Such things as floods, fires, acts of God, accidents, misuse by government personnel, or improperly completed maintenance represent typical exclusions one would expect to find addressed in warranty guidance.

Funding. The last issue to be discussed regarding the acquisition aspect of warranties is funding. As mentioned previously, warranties typically cost money and such allowances should be provided for early in the acquisition cycle. However, a possible abuse of warranties related to funding that should be guarded against may be their use as a "long term maintenance instrument" or what is often referred to as interim contractor support. That is to say, warranties with excessively long durations could be acquired with procurement funds, with the intent being to provide long-term maintenance benefits rather than their intended short term quality assurance benefits. This may initially appear to be acceptable from the insurance aspects of warranties. However, the insurance aspect of warranties should not be the intent of the DoD acquired warranties. As mentioned before, the purpose of the warranty should be in raising the reliability, quality, etc. of the delivered system. The inappropriate use of funds could defeat this purpose and use scarce funding resources for an inappropriate purpose. While this may seem to be an issue involved with program management, regulatory coverage of this issue may prevent warranties from being acquired for the wrong reasons.

The next area of discussion regarding the analysis and administration of warranties involves the aspect of warranty enforcement.

Enforcement Issues in Warranty Administration

The effective enforcement of a warranty is essential if its true benefits are to be realized by the buyer. When warranties are not enforced and the user makes the repairs to the system at its expense, the warranty is usually voided and two conditions result.

First, warranty claim costs for the manufacturer decrease. A review of the model in figure 2 will help explain this result. As the warranty claim cost line shifts downward, the new total cost curve also moves lower. Accordingly, the manufacturer will produce at that point on the total cost curve where it is at its lowest point. Thus, the delivered level of reliability will be closer to R' rather than R". Although reliability is lessened, it is still greater however than if no warranty had been provided at all. Additionally, by not having to act on these warranty claim costs, the manufacturer will realize an increase in its profits (3:66).

The second condition that results when the user makes the warranted corrections is that it incurs additional or increased costs. These costs would not have been incurred if the manufacturer had made the corrections. While not increasing the buyer's explicit costs, its implicit costs are increased (3:66). As such, warranty enforcement is an area that should be addressed by warranty regulations.

This section of the thesis will address the enforcement aspect of warranties. Responsibility to enforce the warranty, warranty failures, and warranty remedies are the specific issues that will be discussed.

Enforcement Responsibility. As in the acquisition aspect of warranties, an important element in enforcement is also to determine who is responsible for enforcing the warranty. This will depend upon the nature and complexity of the warranty and the system itself that is under warranty. Simple, straight forward warranty requirements may be able to be handled by the user of the item. On the other hand, large and complex requirements may require the expertise of contract administration functions.

In any event, a warranty implementation plan provides an excellent way to determine warranty enforcement responsibility. A warranty implementation plan

is a written document that describes the warranty, sets forth the duties and responsibilities of those involved with the warranty, and addresses the actions necessary for successful warranty administration (2:6-2). The previously referenced Warranty Handbook published by DSMC sets forth various conditions that would require a warranty implementation plan:

> 1. The warranty contract provisions require the Government to perform actions or tasks;
>
> 2. The contractor is required to perform actions or tasks that will need Government monitoring, inspections, or reaction;
>
> 3. The contractor is required to submit deliverables related to the warranty; and,
>
> 4. There is a requirement to evaluate the effectiveness of the warranty requirement. (2:6-3)

The warranty implementation plan would most likely be written by the authors of the warranty contract provisions and be prepared after the warranty contract provisions have been written. Thus, the final plan should be available in sufficient time to allow for its effective and timely implementation (2:6-4). Such a plan provides an excellent forum for the agreement to and the assignment of warranty responsibilities. Warranty regulations stipulating the development of such a plan would go a long way in assuring the clear designation of warranty administration responsibilities. At the very least, regulations concerning warranty administration should provide the necessary guidance in assigning appropriate responsibilities, including enforcement.

Failures. In discussing the aspects of warranty enforcement, the issue of failures is very important. Ineffective enforcement would be tantamount to having no warranty coverage at all. Therefore, identifying that a failure has occurred and communicating this fact to the warranty enforcement official is

essential. Accordingly, the user must know that a warranty exists and the procedures to follow when failures are identified. Determining what constitutes a failure and the actual occurrence of such a failure, plus documenting the failure all add to increased enforcement effectiveness. While this should be addressed in the actual warranty contractual provisions, failures should also be addressed in warranty regulations to allow for the proper construction of such provisions.

Remedies. Related to failures is the issue of the remedies available once a failure is detected and confirmed. The warranty law requires that the contractor repair or replace the system to meet the specifications or bear the expense of the government corrections. To remain in consonance with the warranty law and to ensure effective warranty enforcement, the warranty regulations should stipulate the remedies to be considered in warranty enforcement.

Evaluation Issues in Warranty Administration

The last aspect of warranty administration to be addressed in this thesis is the aspect of warranty evaluation. Evaluating warranties previously acquired could help the DoD make improvements in warranties proposed for future acquisitions. Knowing how warranties have worked in the past and what their associated problems were may prevent similar problems from recurring. Thus, a system that allowed pertinent warranty data to be gathered, stored, and shared among warranty users would be extremely beneficial. The last section of this chapter will discuss warranty evaluation issues including evaluation responsibility, criteria involved in evaluating warranties, and the importance of a central collection center for maintaining warranty data.

Evaluation Responsibility. An important point to consider in discussing evaluation issues of warranties is determining who will be evaluating the

warranty. As in warranty enforcement, warranty evaluation by the proper organization or agency is critical to the warranty's success. Additionally, future warranties may benefit from the proper evaluation of current warranties, thus possibly preventing mistakes in both the application and execution. An excellent opportunity exists in delineating this responsibility in the warranty implementation plan discussed previously under enforcement responsibility. This document would provide an excellent forum for the interested parties to agree who will evaluate the warranty.

Evaluation Criteria. In addition to determining who will evaluate the warranty, the criteria used to provide for a fair and effective evaluation should be clearly set forth in the warranty regulations. Criteria such as warranty costs, the increased reliability of the system and the improved performance would provide a basis for consistent evaluation of a warranty. This can be valuable for future warranty acquisition considerations and contract negotiations.

Evaluation Collection Center. To be effective, the information used and obtained in the evaluation should be available in one central location. This will benefit not only those who performed the evaluation, but other organizations who may need to acquire a similar warranty or warranted system at a later date.

Chapter Summary

This chapter presented the issues commonly associated with the acquisition, enforcement, and evaluation of warranties in the DoD. The purpose was to discuss what seems to be some of the more important issues involved in warranty administration and to stimulate the readers' thoughts about what should be covered by DoD warranty regulations. The issues presented in this chapter can easily be summarized by the left most column in Table 1. Chapters

three, four, and five of this thesis will discuss how the previously identified warranty issues are addressed by each of the service's regulations on warranties. Accordingly, the blank columns to the right will be completed as chapters three, four, and five are presented.

TABLE I
SUMMARY OF WARRANTY ISSUES

ASPECTS	USAF	ARMY	NAVY
Acquisition Issues			
Buying Responsibility			
Reasons for Buying			
Cost-Benefit Analysis			
Waiver Procedures			
Prices			
Coverage			
Duration			
Identification			
Failures & Remedies			
Exclusions			
Funding			
Enforcement Issues			
Enforcement Responsibility			
Failures			
Remedies			
Evaluation Issues			
Evaluation Responsibility			
Criteria			
Central Collection Center			

III. Acquisition Issues of Warranties

The previous chapter presented the issues associated with the acquisition, enforcement, and evaluation of warranties in the DoD. This chapter will focus on the acquisition issues identified in Chapter 2, and provide an analysis of the services' coverage of each identified issue in their warranty regulations. Two regulatory documents will form the basis of the analysis. The first warranty document to be reviewed will be each agency's supplement to the Federal Acquisition Regulation. The second document will be the agency's primary regulation on warranties.

However, it is appropriate to first review warranty coverage in the FAR itself and the DoD FAR Supplement (DFARS) for two reasons. First, the FAR is the primary regulation used by the executive agencies in acquiring their needed supplies and services. Second, the DFARS sets forth policies and procedures unique to the Department of Defense. After reviewing the FAR and DFARS, each agency's supplement to the FAR will be examined for any coverage of the warranty acquisition issues, followed by a review of the service's primary warranty regulation. The chapter will conclude with a summary and brief comparison of the acquisition aspects of warranties in the DoD.

The Federal Acquisition Regulation

Broad and general guidance on warranties is found at Subpart 46.7 of the FAR. This section of the FAR briefly discusses in general the criteria for using warranties, some warranty limitations, and prescribes contract clauses that may be inserted (with alterations authorized) into contracts. More specific and extensive coverage is given to warranty terms and conditions at FAR 46.706.

This section of the FAR requires that contracting officers ensure warranties clearly state the:

1. Exact nature of the items and its components and characteristics that the contractor warrants;

2. Extent of the contractor's warranty including all of the contractor's obligations to the Government for breach of warranty;

3. Specific remedies available to the Government; and,

4. Scope and duration of the warranty. (25:Subpart 46.706)

The FAR continues with an elaboration of the foregoing issues. It also mentions other issues that should be considered such as the amount of time the government has to provide notice to the contractor of detected failures, the markings of warranted items, and maintaining consistency throughout the contractual document relative to the warranty (25:Subpart 46.706).

DOD Federal Acquisition Regulation Supplement

The DFARS also provides only general guidance concerning warranties. However, it does set forth the DoD policy in obtaining warranties pursuant to 10 U.S.C. 2403. The DoD policy is clear regarding warranties for weapon systems. Because it should formulate the basis for Air Force, Army, and Navy policy, it is quoted here in full text:

(a) Unless waived under 46.770-9, after 1 January 1985, the Military Departments and Defense Agencies may not enter into a contract for the production of a weapon system with a unit weapon system cost of more than $100,000 or for which the eventual total procurement cost is in excess of $10,000,000, unless:
(1) a prime contractor for the weapon system provides the United States with written warranties that--
(i) the weapon systems provided under the contract conform to the design and manufacturing requirements specifically delineated in the contract (or any modification to that contract),
(ii) the weapon systems provided under the contract are free from all defects in materials and workmanship at the time of acceptance or delivery as specified in the contract; and

(iii) the weapon systems, if manufactured in mature full-scale production, conform to the essential performance requirements as specifically delineated in the contract (or any modification to that contract);

(2) the contract terms provide that, in the event the weapon system fails to meet the terms of the above warranties, the contracting officer may --

(i) require the contractor to promptly take such corrective action as necessary (e.g., repair, replace and/or redesign) at no additional cost to the United States,

(ii) require the contractor to pay costs reasonably incurred by the United States in taking necessary corrective action, or

(iii) equitably reduce the contract price.

(b) Contracting officers may require warranties that provide greater coverage and remedies than specified above, such as including an essential performance requirements warranty in other than a mature full-scale production contract. (5:Subpart 46.770-2)

Additional DoD policy regarding warranties set forth in the DFARS is that only cost-effective warranties will be obtained, and warranty clauses will not include terms that cover contractor liability for loss, damage or injury to third parties (5:Subpart 46.770-2).

The DFARS does not provide specific procedural directions concerning warranties. It does however specifically require:

1. The establishment of agency procedures to track and accumulate data relative to warranty costs;

2. Warranted items to be marked according to MIL Standard 129 and 130;

3. The designation of a weapon system's essential performance requirements;

4. A cost benefit analysis to be performed;

5. Congressional notification of waiver intentions;

6. Establishment of agency procedures for processing waivers, notifications and reports to Congress; and,

7. The insertion of a clause into contracts and solicitations that describes the warranty of the system. (5:Subpart 46.7)

The remaining portions of the DFARS Subpart 46.7 defines terms related to warranties, recommends contract clauses that could be used, and provides

some general guidance on tailoring warranty terms and conditions. This general guidance permits contracting officers to tailor warranties with regard to remedies, exclusions, and durations to meet the circumstances and objectives of a particular program. However, such tailoring must be consistent with the requirements of DFARS 46.770 and 46.706 (5:Subpart 46.770-3).

Having briefly reviewed the warranty coverage in both the FAR and the DFARS, the examination and analysis of the individual service's warranty regulations regarding the acquisition aspect of warranties will complete this chapter. As previously stated, two regulatory documents will form the basis of the review for each service's warranty coverage. These two documents will be the agency's supplement to the FAR and the agency's primary warranty regulation. The first agency to be examined is the United States Air Force.

The United States Air Force

The two Air Force documents to be examined for their treatment of warranty issues are the Air Force FAR Supplement (AFFARS) and Air Force Regulation (AFR) 800-47 entitled "Weapon System Warranties". AFR 800-47 is a new regulation. The interim implementation copy is dated 17 May 1988, was issued 10 June 1988, and was used for the review in this thesis. This regulation provides policies, lists procedures, and assigns responsibilities for acquiring, administering, and reporting weapon system warranties.

The DoD policy mentioned previously is reiterated in Section B of the regulation. Paragraph 4b requires all weapon systems meeting the statutory dollar threshold to:

1. Conform to the design and manufacturing requirements specifically delineated in the production contract;

2. Be free from all defects in material and workmanship at the time of delivery; and,

3. Conform to the essential performance requirements of the item as specifically delineated in the production contract. (7:Para 4b(1)-(3))

These specific regulatory requirements are in consonance with both 10 U.S.C. 2403 and DFARS 46.770-2. The acquisition issues previously identified in Chapter 2 will now be reviewed for their treatment by the AFFARS and AFR 800-47.

Buying Responsibility. The AFFARS places heavy emphasis on planning and requires the development of a warranty plan for all warranties required by the warranty law. It must be a written plan and address the acquisition, administration, and enforcement of the warranty. One of the required areas that must be addressed in the warranty plan is warranty team membership. Team membership must be listed along with a description of the team's organizational management responsibilities (6:Subpart 46.770-90). Attachment 2 to AFR 800-47 elaborates on the warranty plan. It provides examples of team members as warranty managers, contracting officers, engineers, logisticians, cost analysts, using and supporting command representatives, and others determined to be necessary for warranty administration (7:Atch 2, para e).

While the team approach is advocated by both the AFFARS and AFR 800-47, team leadership is assigned to the Program Manager (PM). Specifically, the PM is required by AFR 800-47 to:

1. Establish and implement a Weapon System Warranty (WSW) program;
2. Structure and establish a warranty team;
3. Ensure the WSW plan is developed, coordinated and approved; and,
4. Designate the WSW manager and identify his specific functions and responsibilities. (7:Para 29a)

AFR 800-47 also prescribes the WSW manager's minimum taskings. In summary, he is to:

1. Manage and integrate the requirements of the involved commands;
2. Plan for warranted system administration;
3. Manage and coordinate warranty application, enforcement, and administration requirements;
4. Coordinate and resolve warranty program requirement disputes;
5. Brief WSW status to the PM;
6. Coordinate planning for program management responsibility transfer (PMRT) relative to warranty administration; and,
7. Provide a copy of the approved warranty plan to the USAF Product Performance Agreement Center. (7: Para 29d)

In summary, the Air Force advocates a team approach to warranty acquisition, with specific duties and responsibilities assigned to two key figures.

Reasons For Buying Warranties. The preamble to AFR 800-47 says that "weapon system warranties provide the Air Force ways to motivate contractors to design, produce, and deliver quality weapon systems as well as a means to correct defects for which the contractor is responsible" (7:1). Thus, it appears the Air Force is attempting to realize both the assurance and the insurance benefits of warranties discussed in Chapter 2. Section D of the regulation introduces a product performance agreement. These were defined earlier in Chapter 1 and incorporate incentive-type warranties that are used to assure a desired level of performance is achieved by the system (7:Para 17). The focus here is obviously on the realization of the assurance benefit of warranties.

Cost-Benefit Analysis. AFR 800-47 reiterates the DoD policy of obtaining only cost-effective WSWs. It requires that a cost-benefit analysis (CBA) be accomplished, even if a WSW is offered by a contractor at no cost to the

government. It references AFR 173-15, paragraph 4-8 as providing Air Force guidance on completing the CBA. Additionally, the Air Force PPAC has developed a computer model to assist in completing a WSW CBA. Both the AFFARS and AFR 800-47 require that the methodology used in completing the CBA be described and the results of the CBA be summarized in the warranty plan.

However, this minimal coverage on CBAs may not be sufficient. A recent study by Captain H. L. Harting of the Air Force Product Performance Agreement Center (PPAC) found that it appears few contracting people are actually completing the CBAs. This seems to be due to the fact that most contracting people do not know how to accomplish a CBA. Moreover, Air Force Guidance on CBAs is minimal, causing individuals to create CBA models they are not skilled in creating (17:2). Captain Harting feels that one possible solution to this problem is requiring the PPAC to receive copies of completed CBAs. This would allow the PPAC to better assist other acquisition activities in the preparation of future CBAs.

Additionally, neither the AFFARS or AFR 800-47 require that the CBA be filed in the contract file. While this may appear to be a self-evident requirement, having no regulatory requirement could result in non-existent CBAs and a possible circumvention of the CBA requirement altogether.

Accordingly, this oversight suggests that paragraph 6 of AFR 800-47 should perhaps be amended to require completed CBAs be included in the contract file and a copy forwarded to the Air Force PPAC.

Waivers. Both the AFFARS and AFR 800-47 comply with the requirement of DFARS 46.770-9(d) by providing agency guidance in processing waivers. AFR 800-47 repeats the guidance of the AFFARS almost verbatim, as they each

require waivers to be processed according to the DFARS, and additionally requires that:

> 1. A copy of the CBA if the basis of the waiver is that a warranty would not be cost effective;
>
> 2. Action taken to assure product quality and achievement of EPRs in lieu of obtaining a warranty; and,
>
> 3. Mandatory exercise data of the warranty option, if applicable. (7:Para 15b)

Neither document requires waivers to be prepared in a specific or standardized format. Such a requirement could possibly ease the preparation and submission requirements placed upon those contemplating the submission of waivers and may encourage more requests for waivers to be submitted.

Pricing. The AFFARS and AFR 800-47 both address warranty pricing to an extent. They both require contractors to fully justify and provide detailed cost breakdowns for any proposed costs associated with providing a WSW. AFR 800-47 provides only general guidelines in developing a WSW price. It allows a warranty price to include reasonable costs that may be incurred for repairs or failures occurring early in the production process that are attributable to manufacturing or material and workmanship defects. However, profit on these repairs is not allowed.

The regulation does not allow costs for redesign to be included in the price of the warranty. If however the government had specified or provided the design, cost incurred by the contractor for redesign may be included as part of the warranty price.

Reasonable costs associated with warranty administration may also be included in the warranty price. The regulation mentions a warranty manager's

salary and a management information system used to track warranty data as examples of such cost that may reasonably be included in the warranty price.

Finally, the regulation cautions against using a rule-of-thumb approach in determining a warranty price. It encourages a "bottom-up approach" and the use of cost-estimating relationships if relevant cost data is available (7:Para 7).

Although the regulation mentions the Armed Services Pricing Manual for pricing guidelines, the foregoing is the extent of the pricing guidance provided by the regulation. While minimal coverage may allow flexibility for the various applications involved with warranties, it provides warranty users with little more information than was available prior to the release of the regulation.

The PPAC is currently studying warranty prices and has found that the majority of price negotiation memorandums they reviewed did not address how the negotiated price was arrived at, but simply that the price was fair and reasonable (17:2).

To provide assistance in this critical area of pricing, the PPAC is working on creating a warranty pricing policy and methodology for use within the acquisition community. Hopefully upon completion, their efforts will result in more specific pricing procedures that will subsequently be included in the warranty regulation.

Warranty Coverage. The guidance on the extent of warranty coverage of WSWs by the USAF is brief. AFR 800-47 states that "generally system level essential performance requirements (EPRs) are selected for warranty coverage rather than EPRs at lower level tiers such as components or line replaceable units" (7:Para 8c). No where else in the AFFARS or in AFR 800-47 is guidance provided in determining whether warranties apply to the system level or the sub-system level. Although unlikely, it is possible that the regulation dealing with the CBA addresses this issue. However, a review of documents other than the

primary warranty regulations has been determined to be beyond the scope of this thesis.

Durations. The AFFARS and AFR 800-47 do discuss warranty durations. The AFFARS requires "to the maximum extent possible, state the warranty duration as a fixed calendar date or in calendar time from the date of delivery". The AFFARS goes on to state that the "warranty duration should be no longer than required to identify defects" (6:Subpart 46.770-93). AFR 800-47 echoes the foregoing in its Attachment 3 entitled "WSW Clause Development". Additionally, other considerations that AFR 800-47 mentions include whether the:

1. Warranty duration applies to an individual unit or to a group or subgroup;

2. Warranty duration starts with acceptance (delivery) or at a time of installation of the unit in a higher level assembly; and,

3. Warranty period can be extended and under what conditions. (7:Atch 3, para e)

This coverage of durations is adequate in that the start of the warranty coverage and the actual durations are both addressed.

Warranty Identification. Both the AFFARS and AFR 800-47 require warranted items to be clearly marked whenever possible. As in the area of waivers, the regulation repeats the coverage of the AFFARS almost verbatim. Both require markings according to MIL-STD-129 and MIL-STD-130, thus reiterating the requirement of the DFARS. The markings are to be "conspicuous to the person removing the item from service, and the period or conditions of the warranty must be specifically stated" (7:Atch 3,para g). This requirement should help in preventing unsuspecting maintenance workers and users of the items from inadvertently voiding warranties.

Failures and Remedies. As mentioned in Chapter II, performance requirements should be clearly established and described in order to determine

when a failure has occurred. The AFFARS requires that essential performance characteristics that are to be warranted be described in the warranty plan. With regard to the identification of failures, this is briefly addressed in Attachment 4 to the regulation. EPR failures are identified by a comparison of actual field performance to what was originally required in the specifications. To accomplish this comparison, the regulation requires the establishment of a management system that accepts field performance data. The identification of a failure attributable to defects in material and workmanship and nonconformance to the design and manufacturing requirements is accomplished by a personal inspection and evaluation of the warranted item (7:Atch 4, para 4a). The regulation also references Technical Order TO 00-35D-54 for additional guidance on further analysis of warranty failures.

Remedies are addressed in AFR 800-47 in several areas. This issue will be examined in greater detail in Chapter 4 relative to the discussion on warranty enforcement issues. At this point, it is sufficient to note that remedies are covered and such coverage is consistent with both the warranty law and DFARS 46.770-2.

Exclusions. AFFARS 46.770-3(b) briefly addresses this issue. It allows contracting officers to exclude "contractor correction of defects that are beyond the reasonable control of and not attributable to any fault of the contractor" (6:Subpart 46.770-3(b)). Such exclusions may typically include such things as combat damage, misuse by government personnel and accidental damage. The only mention of exclusions in AFR 800-47 is in Attachment 3 under warranty clause development. It requires that any warranty exclusions such as mishandling, fire or combat damage be identified in the warranty clause and that DFARS 46.770-3 as supplemented be consulted.

Funding. Neither the AFFARS or AFR 800-47 address the issue of funding. The only guard against the improper use of warranties as a long term maintenance instrument as discussed in Chapter 2 is the language at AFFARS 46.770-93 (a)(2). This recommends warranty durations to be no longer than necessary to identify defects in the item or system.

This concludes the examination of the Air Force's coverage of warranty acquisition issues in the AFFARS and its primary warranty regulation, AFR 800-47. The next agency to be examined is the United States Army.

The United States Army

The two Army documents to be examined for their treatment on warranties are the Army FAR Supplement (AFARS) and Army Regulation (AR) 700-139 entitled "Army Warranty Program Concepts and Policies". The coverage of warranties by the AFARS is minimal, with the majority of it devoted to waiver and notification procedures. Accordingly, the focus of the ensuing review and analysis will be on AR 700-139.

AR 700-139 was issued 10 March 1986, superseding Army Warranty Program AR 702-13 dated 1 February 1981. This regulation "assigns responsibilities, states acquisition policies, defines information requirements, covers fielding and execution procedures and prescribes methods of compliance" (9:1).

The regulation does not reiterate the DoD policy on WSWs as does the Air Force regulation, but rather states "warranties will be acquired or waivers requested for items considered as weapon systems in accordance with 10 U.S.C. 2403 and the regulatory requirement of DFARS 46.7" (9:Para 3-2a). This

statement leaves little room for doubt that the acquisition of warranties by the Army is mandatory and furthers compliance with the law and the DFARS.

The AFARS and AR 700-139 will now be reviewed for their treatment of the acquisition issues identified in Chapter 2.

Buying Responsibility. Unlike the Air Force, the Army regulation does not advocate a team approach to warranty acquisition nor is a specific individual office or person charged solely with the responsibility of acquiring the warranty.

However, this overall responsibility is assigned to the materiel developer (MATDEV), which is the command or agency within the Department of the Army responsible for the development or acquisition of a particular program or system. The MATDEVs are required to issue supplemental policies and procedures that apply to the acquisition of material warranties (9:Para 2-6b). Accordingly, it is quite possible that this responsibility may be established within each MATDEV through these supplemental policies and procedures. As such, the responsibility could vary throughout the Army.

However, for the purpose of this research effort, neither the Army FAR Sup or AR 700-139 specifically designates a particular person or position to acquire warranties.

Reasons For Buying Warranties. The Army regulation does not specifically state why warranties should be purchased. It does however discuss two concepts of warranties that merit a brief discussion at this point. These two concepts are the expected failure concept and the failure-free concept. From these two concepts, it is possible to understand the advantages the Army hopes to obtain from warranties.

Expected Failure Concept. This concept is based on "the knowledge that the Army procures materiel to the minimum needs of the Army; therefore any

design will include failures" (9:Para 4-2a). Accordingly, contractors should not be held responsible for these expected failures, but should only be liable for those that exceed them. The Army's claimed benefits under this concept include:

1. The warranty cost is minimal or non-existent as remedies are only required for those that exceed the expected number of failures;

2. Realizing fewer failures than expected indicates an increase in reliability and represents cost avoidances; and,

3. Failures that exceed those expected are remedied by the contract warranty. (9:Para 4-2a(4))

Failure-Free Concept. This concept requires a period in which the item performs with no failures. Failures detected during this period are subject to the remedies set forth in the warranty provisions of the contract. This is referenced as being similar to warranties obtained in the commercial market (9:Para 4-2b).

By employing these two concepts, the Army appears to be attempting to capitalize on both the assurance and insurance benefits of warranties.

Cost-Benefit Analysis. AR 700-139 charges the MATDEVs to institute procedures that determine the cost-effectiveness of warranties. The regulation reiterates the DoD policy of acquiring only cost-effective warranties and requires that a formal cost-effectiveness (C-E) analysis be completed for each weapon system warranty. AR 700-139 references two additional Army regulations, AR 11-18, "The Cost Analysis Program" and AR 11-28, "Economic Analysis and Program Evaluation for Resource Management" for apparent use in completing the CBA. These two documents will not be commented on as it was previously noted that examinations of regulations or directives other than the agency's supplement to the FAR and its primary warranty regulation are beyond the scope of this thesis.

Additionally, an internal control review checklist for the cost-effectiveness determination is required for each contract warranty (9:Para 4-3).

The regulation is explicit in requiring a CBA, and the required internal control review checklist provides good step-by-step directions in completing the CBA. The checklist also requires the contract file to be documented as to the outcome of the C-E analysis and the rationale for the warranty decision. This sound contract administration policy could be further reinforced by the regulation itself requiring the actual C-E analysis to be included as part of the contract file.

Waivers. AFARS 46.770-9 complies with the requirement of DFARS 46.770-9(d) by providing agency procedures for processing waivers. This subpart of the AFARS requires waivers to contain the same information required by DFARS 46.770-9(d) plus:

1. Identification of all warranty costs and procedures used to evaluate cost effectiveness;

2. What efforts were made to negotiate a modified warranty;

3. If entire system is not warranted; any warranties obtained on individual components;

4. Commercial or other guaranties to be included in lieu of required warranty provisions; and,

5. Actions taken to preclude waivers on future procurements. (8:Subpart 46.770-9)

Pricing. The Army regulation makes only very brief comments regarding the prices and costs associated with warranties. These are included in the discussion of the two warranty concepts employed by the Army. Under the expected failure concept of warranties, the initial warranty is provided at little or no cost to the Army. Under the failure-free concept, the cost of the warranty may be included in the price of the item or it may be included as a separate cost

(9:Para 4-2). These are the only mention of warranty prices or costs in either the regulation or the AFARS.

This is an issue that is too important to not be addressed in either document. Without pricing guidance, those acquiring warranties are left to operate on general rule-of-thumb techniques that are typically inaccurate and may result in contractors realizing unearned profits. The regulation should be modified to at least address the issue of pricing and provide those working with warranties more specific procedures to follow when formulating warranty prices.

Warranty Coverage. The Army regulation specifically addresses the topic of warranty coverage in paragraph 4-8. Here warranty coverage is divided into two categories, individual item failure coverage and systemic defect coverage. However, this section does not provide the guidance necessary to determine what is to be warranted.

According to Mr. Taras Galysh of HQ Army Materiel Command, individual item failure coverage applies the provisions of the warranty to every item on the system that has been identified to be covered under the warranty. Every time that a warranty failure occurs, a warranty claim action is completed.

On the other hand, systemic defect coverage applies to the entire fleet or lot of the weapon system. When it appears the entire fleet of the system begins to experience the same failure, this trend indicates a systemic defect (13).

The criteria for determining what is to receive a warranty is addressed in Section 4-7. Here specific criteria for determining warranty candidates is outlined. Basically for weapon systems, the regulation requires all systems as defined in 10 U.S.C. 2403 to be warranted plus items subordinate to major weapon systems that meet the dollar threshold of DFARS 46.7 and that occur no lower than level 3 in the work breakdown structure (9:Para 4-7a).

With regard to individual versus systemic failures, individual item failure coverage covers only those items down to level 3 whereas systemic defect coverage covers anything at any level of engineering or maintenance (13).

Durations. The regulation is thorough in addressing the issue of warranty durations. The coverage is clear, concise, and logical. The regulation requires "warranty durations to be of sufficient time to provide a period of user operation that is proportional to the expected life of the item" (9:Para 4-9).

Warranty durations are calculated by adding together two factors. The first factor is the average elapsed time prior to operation and the second factor is operational use. The average elapsed time prior to operation is simply the time period from delivery of the item to the time it is first used. It includes delays that normally would be encountered in transporting the item, storing the item, etc.

The second factor, operational use, is the period of time that the item is in actual use long enough to "prove the substantive quality of the item and the integrity of the manufacturing process" (9:Para 4-9b). The regulation calculates this to be between 10 and 25 percent of the item's life expectancy, but generally not less than one year. This one year may be simply one calendar year or it may be an equivalent usage basis, such as the number of rounds fired or the number of hours of operation. When added together, these two factors express the warranty duration period, which starts when each item is accepted.

Warranty Identification. Another issue that the regulation covers very well is warranty markings. The regulation requires warranty identification and package marking to be a contract requirement. AR 700-139 also reiterate the requirements of DFARS 46.706 by requiring the adherence to both MIL-STD-129 and MIL-STD-130. Additionally, the regulation requires as a minimum the markings include:

1. "WARRANTY ITEM"

2. "WTBXXXX" (unique number) (WTB stands for Warranty Technical Bulletin); and,

3. "EXPIRES XX/XX (unique date/rate). (9:Para 4-11a(1))

The regulation even goes so far as to specify the background marking's color and sizes. This level of emphasis should make all users and maintenance technicians fully aware of the item's warranty.

Failures and Remedies. These two issues as they relate to the acquisition aspect of warranties are not discussed in either the AFARS or AR 700-139. This oversight leaves those acquiring warranties with no direction or guidance in this area when developing warranty terms and clauses. As such, inadequate warranty coverage and enforcement could result. It is also possible that by not expressly requiring what remedies should be contractually required, less than full compliance with 10 U.S.C. 2403 may result. While DFARS 46.770-2 does require specific remedies be contractually required, re-emphasis of these by the regulation would reinforce their importance.

Exclusions. Neither the Army FAR Supplement or AR 700-139 mention what may constitute an exclusion or an exception to a weapon system warranty.

Funding. This issue is not addressed by either the AFARS or AR 700-139.

This completes the review of the Army coverage of acquisition issues in its warranty regulation and FAR Supplement. The last agency to be reviewed is the United States Navy.

The United States Navy

The two Navy documents to be examined for their treatment of warranty issues are the Navy FAR Supplement (NARSUP) and Secretary of the Navy Instruction (SECNAVINST) 4330.17 entitled "Navy Policy on Use of Warranties".

However, before continuing with the Navy analysis, a few words concerning these two documents are in order.

First, the coverage given to warranties in the NARSUP is not extensive. Second, when the proposed draft version of SECNAVINST 4330.17 was circulated in the Fall of 1985, it initially addressed some of the warranty issues identified in Chapter 2. However, the final version dated 18 September 1987 is a mere two page document which basically sets forth its purpose, scope and the Navy policy requiring warranties. It also charges the Chief of Naval Operations (CNO) to:

> 1. Establish procedures to ensure that warranties are obtained for weapon systems meeting the requirements of 10 U.S.C. 2403 and other supplies and services per FAR Subpart 46.7 and DFARS 46.7;
>
> 2. Establish procedures to ensure the maximum use of warranted products before expiration of the warranty periods;
> 3. Establish a warranty reporting system;
>
> 4. Develop procedures for immediate issuance of credit to the end item users when requisitioned products under warranty are found to be defective upon installation; and,
>
> 5. Develop a warranty data collection system for subsequent warranty evaluation and analysis. (12: Para 4(a)(1)-(5)

However, the foregoing procedures have not yet been developed by the office of the CNO. According to Commander Mel Rushing, because the Navy does not have a separate materiel or acquisition command, buying and acquisition responsibilities are spread among the Navy's five individual Systems Commands (SYSCOMs). Each SYSCOM has unique requirements and is faced with varying problems associated with effective warranty implementation procedures. As such, the SYSCOMs require flexibility to tailor warranties to their specific needs. Accordingly, this makes it extremely difficult to issue a consolidated Navy regulation on warranties that is both specific and extensive (22).

The office of the CNO is trying to approach the taskings of SECNAVINST 4330.17 in a positive manner. Commander Rushing envisions broad guidance to be issued to each of the SYSCOMs, with each SYSCOM in turn returning their specific implementing instructions to the CNO for review and approval. Toward this end, the office of the CNO is attempting to determine what has been done and is meeting with representatives from each of the SYSCOMs to work on developing an overall Navy approach for warranty implementation. Subsequent to this, a consolidated regulation may be issued (22:).

The foregoing helps to explain why the coverage on warranties by the Navy's two primary warranty documents is minimal. As a result of this minimal coverage at the agency level, using one of the Navy's SYSCOM's procedures and published guidelines for comparative purposes in addressing each issue was considered. This was subsequently rejected however and the decision was made to keep the review at the agency level to provide for uniformity and consistency throughout this thesis. With this in mind, SECNAVINST 4330.17 and the NARSUP will now be reviewed for their coverage of the warranty acquisition issues identified in Chapter 2.

Buying Responsibility. The responsibility for acquiring warranties is not expressly assigned in either the NARSUP or SECNAVINST 4330.17. No one particular position such as the program manager or the contracting officer is assigned this responsibility, nor is the team approach directly advocated. The NARSUP does encourage contracting officers, program managers and project officers to contact the PPAC at Wright-Patterson AFB for assistance with warranty clauses and cost-benefit analysis models. While this may imply a team approach is advocated by the NARSUP, it is not expressly mentioned in either document. This issue is one which the CNO should address in its pending

warranty guidance, with the recommendation made to encourage and advocate the use of a team approach.

Reasons For Buying Warranties. SECNAVINST 4330.17 states that its purpose is to:

> ensure that the Department of Navy (DON) obtains and administers warranties that enhance the quality, reliability and performance of systems, subsystems and materials. (12:Para 1)

This seems to imply the Navy intends to capitalize on the assurance aspect of warranties. On the other hand, the instruction also emphasizes developing procedures for issuing customer credit for defective items, using items prior to the expiration of their warranties, and the establishment of a warranty data system. This seems to imply capitalization of the insurance aspects of warranties. Thus it appears the Navy intends through its warranty implementation procedures to realize both the insurance and the assurance benefits of warranties.

Cost-Benefit Analysis. This very important issue is barely addressed in the Navy's documents. The only mention in the NARSUP is that CBAs must be included in Section VIII of the business clearance memorandum (10:Subpart 46.770-8) and it also encourages contacting the PPAC for assistance regarding CBA models (10:Subpart 46.710). The draft version of SECNAVINST 4330.17 referenced SECNAVINST 7000.14B, "Economic Analysis and Program Evaluation for Navy Resource Management". Also, the proposed draft included warranty CBA guidelines that helped to explain the costs and benefits associated with warranties. However, the final version of the instruction does not include this regulatory reference, or the warranty CBA guidelines or any other guidance concerning CBAs.

This minimal coverage in these two documents leaves those faced with determining the cost-effectiveness of a proposed warranty with literally no guidance in completing the CBA, nor does it provide any clues where such guidance could be found. As a minimum, references to other documents used in completing CBAs should be made in the proposed Navy guidance. Additionally, the requirement to include the completed CBA in the contract file would reinforce the requirement of actually accomplishing the CBA.

Waivers. Neither the NARSUP or the instruction list procedures for processing waivers as required by DFARS 46.770-9(d). It is possible that such procedures are published by each of the SYSCOMs. However, for the purpose of this research, these two documents do not address waiver procedures.

This oversight could result in warranties being obtained when in fact requesting a waiver would be more appropriate. Accordingly, this issue should also be included in the forthcoming Navy document.

Pricing. Both the NARSUP and SECNAVINST 4330.17 are silent concerning this issue. This is not surprising, as Navy policy has been that warranties should generally be obtained at no additional cost to the Navy (27:47, 11:Para 5a). It is not the intent of this thesis to make recommended changes to Navy policy. However, comments received from the Navy's field activities found a "no-cost" warranty policy to be troublesome and inconsistent with past experiences (11). Accordingly, it may be worthwhile for the Navy to re-examine this issue and provide those working with warranties appropriate guidance on warranty pricing in future Navy guidance.

Warranty Coverage. SECNAVINST 4330.17 states that it is Navy policy to acquire warranties for weapon systems as defined by 10 U.S.C. 2403 and other supplies and services when the contracting officer determines it to be in the best

interests of the government (12:Para 3a). Thus it appears the Navy intends to obtain warranties at both the system level and subsystem level. However, no guidance is provided regarding the issues that should be considered when making a determination to acquire a warranty at the system versus subsystem level.

Durations. This is one of the few issues that is addressed in the NARSUP. While brief, it does capture two areas of importance regarding warranty durations.

First, it requires that both the operational characteristics of the item to be warranted and the time likely to elapse between acceptance by the government and the actual end-user of the item be considered. Second, it stipulates that the total duration should be long enough to identify any defects or failures that may occur during the item's service use (10:Subpart 46.706(b)(3)).

Although brief, this minimal coverage at least provides those working with warranties a framework when formulating warranty duration periods.

Warranty Identification. As with warranty durations, this issue is addressed only in the NARSUP. It requires warranted items to be marked with:

1. The national stock number or manufacturer's part number;
2. A serial number or other item identifier;
3. The contract number;
4. An indication that a warranty applies;
5. The manufacturer or entity providing the warranty;
6. Date or time that the warranty expires; and,
7. An indication as to whether or not attempted on-site repair by Navy personnel will void the warranty. (10:Subpart 46.706(b)(5))

These marking requirements should help to insure that warranted items are conspicuously marked and that both the end-item user and maintenance personnel are aware of the warranty.

Failures and Remedies. These two related issues are not addressed in either document. While possibly reliant upon the coverage of remedies provided by DFARS 46.770-2(a)(2), this issue would be reinforced by additional coverage in both the NARSUP and the Navy regulation.

Exclusions. As with remedies and failures, exclusions to warranty coverage are not discussed in either document. This omission should be addressed in any forthcoming Navy guidance on warranties.

Funding. Neither the NARSUP or SECNAVINST 4330.17 address the issue of funding. Unlike the AFFARS which requires warranties to be no longer than required to identify defects in the item, the NARSUP requires warranty durations to be long enough to cover the defects discovered during the item's use. This broad latitude for durations could result in warranties being excessively long, thus acting as a long term maintenance agreement in lieu of a contractor incentive to deliver improved reliability and quality.

This concludes the examination of the Navy's coverage of warranty acquisition issues in the NARSUP and SECNAVINST 4330.17.

Chapter Summary

This chapter has focused on the examination of each of the warranty issues identified in Chapter 2 and how each of the three services addressed the issues in their supplements to the FAR and in their primary warranty regulation. A brief summary and comparison of each agency's coverage of each issue along with a

review and update of the Issues Table presented in Chapter 2 will complete this chapter.

Buying Responsibility. When buying warranties, the Air Force advocates a team approach while the Army assigns the responsibility in a generalized way to the material developer. The Navy does not address this issue at all in the warranty documents reviewed.

Reasons For Buying Warranties. All three agencies address this issue in some manner. From the language in each of the service's documents, they all appear to be trying to realize both the insurance and assurance benefits of warranties.

Cost-Benefit Analysis. All three services at least mention the requirement of a cost-benefit analysis. Both the Air Force and the Army reference other department unique documents to follow in accomplishing a CBA, whereas the Navy does not. All three agencies could reinforce and enhance CBA completion and analysis by requiring completed CBAs to be filed in the contract file and by sharing such CBAs via a central collection organization such as the Air Force's PPAC.

Waivers. Both the Air Force and Army reiterate and supplement the requirement of DFARS 46.770-9 by providing agency guidance for processing waivers. Neither of the two Navy documents reviewed provide this guidance.

Pricing. The Air Force's minimal coverage of this issue is the most extensive provided by the three agencies in the documents reviewed. The Army barely addresses warranty prices and the Navy makes no mention of warranty prices whatsoever. This is a very important issue that should be elaborated on and emphasized by each of the services in their warranty guidance. With little or no structure to follow when pricing warranties, individuals may end up paying too

much for the warranty. This potential could be reduced by accurate and comprehensive pricing guidance in the warranty documents or specific references as to where such pricing guidance could be obtained.

Warranty Coverage. The extent of information relative to warranty coverage is brief by all three services. This could be due to the fact the warranty law specifically requires warranties on weapon systems, thus the emphasis by the services is guidance aimed at the system level warranty, with little emphasis if any on guidance below that level.

Durations. All three services discuss the issue of warranty durations in the documents reviewed. By far, the Army regulation provides the most elaborate methodology for calculating warranty durations. As with the Army, both the Air Force and Navy require consideration of the estimated shelf-time or the time from delivery to use of the item. Additionally, both the Army and Navy recommend durations long enough to identify defects in the system.

Warranty Identification. As with warranty durations, the Army regulation is the most elaborate in its warranty marking requirements. All three of the services do require some sort of conspicuous marking of the item with the appropriate warranty data clearly visible to operators and maintenance people.

Failures and Remedies. The Air Force is the only one of the three agencies that addresses this issue in an acquisition context. As mentioned previously, remedies and failures will be examined later as they relate to the enforcement aspect of warranties. However, it would certainly reinforce the requirements of DFARS 46.770-2 if the types of warranties that are appropriate and that should be available to the government were re-emphasized by the services in their regulations.

Exclusions. This issue is addressed only briefly in the Air Force documents and not at all by the Army or the Navy.

Funding. This issue is not addressed by any of the services in either their supplement to the FAR or their primary warranty regulation.

This summary of the services' coverage of the acquisition issues associated with warranties is depicted graphically by Table 2. This is an update of Table 1 from Chapter 2 with the acquisition issues section completed for each service. If the issue was addressed by the agency in either document, regardless of the scope or breadth of the coverage, YES is placed in the matrix. If the issue was not addressed by the service, NO is placed in the matrix.

This concludes the examination and review of the issues associated with the acquisition of warranties and the treatment of these issues by the three services in their FAR supplement and primary warranty regulation. The next chapter will examine the issues of warranty enforcement identified in Chapter 2 and how the services treat these issues in their warranty documents.

TABLE 2
SUMMARY OF ACQUISITION ISSUES

ISSUE ADDRESSED	USAF	ARMY	NAVY
Acquisition Issues			
Buying Responsibility	YES	YES	NO
Reasons for Buying	YES	YES	YES
Cost-Benefit Analysis	YES	YES	YES
Waiver Procedures	YES	YES	NO
Prices	YES	YES	NO
Coverage	YES	YES	YES
Duration	YES	YES	YES
Identification	YES	YES	YES
Failures & Remedies	YES	NO	NO
Exclusions	YES	NO	NO
Funding	NO	NO	NO

IV. Enforcement Issues of Warranties

The previous chapter examined the acquisition issues that were identified in Chapter 2, and provided an analysis of each of the service's coverage of these issues. This chapter will now examine the enforcement issues of warranties that were identified in Chapter 2. As in Chapter 3, this review will be accomplished for each service, with the agency's FAR supplement and primary warranty regulation forming the basis of the review. Also as in Chapter 3, the FAR and DFARS will first be reviewed for their guidance on warranty enforcement issues.

The issues involved with the enforcement of warranties include identifying who will be responsible for enforcing the warranty, identifying warranty failures, and the remedies available under a warranty. As noted in Chapter 2, identifying a warranty failure and determining the cause of such failure is essential if the true benefits of the warranty are to be realized by the user. Improper warranty failure identification by the user could result in the manufacturer not having to provide warranty benefits to the user as originally agreed to by both parties. Consequently, this could in turn result in a drop in the manufacturer's claim costs accompanied by an increase in its profits.

Finally, to realize the full benefits of a warranty and to enhance proper warranty enforcement, the remedies available to the government should be both known to the warranty users and clearly set forth in the contract.

The examination of the foregoing issues will begin by first looking at the FAR and the guidance it provides.

The Federal Acquisition Regulation

The importance of warranty enforcement is set forth at FAR 46.703(c). It says "the Government's ability to enforce the warranty is essential to the effectiveness of any warranty" (25:Subpart 46.703(c)). Toward this end, the FAR stipulates a system for reporting defects should be in place or be able to be established. Warranty enforcement will be facilitated by the contracting officer ensuring that warranties clearly state the:

1. Exact nature of the item and its components and characteristics that the contractor warrants;

2. Extent of the contractor's warranty including all of the contractor's obligations to the Government for breach of warranty;

3. Specific remedies available to the Government; and,

4. Scope and duration of the warranty. (25:Subpart 46.706 (a))

The FAR continues with its recognition of the importance of warranty enforcement by elaborating on warranty remedies. It states that:

> normally a warranty shall provide as a minimum that the Government may (A) obtain an equitable adjustment of the contract, or (B) direct the contractor to repair or replace the defective items at the contractor's expense. (25:Subpart 46.706(b)(2))

When the actions in (B) above are not possible or practical, the FAR recommends the warranty provide alternate remedies. These include retention of the defective item with an equitable downward contract adjustment or repair or replacement by the government of the defective item with reimbursement by the contractor. Should the latter be the case, the contract should also stipulate the contractor's reimbursement requirements. These include the parts and materials required, any installation instructions required, inspection requirements, transportation costs, and the packaging and marking of the repaired or replaced item (25:Subpart 46.706(b)(2)).

DOD Federal Acquisition Regulation Supplement

The DFARS does provide specific guidance on warranty enforcement. First, it provides the following definition of a defect. A defect is:

> any condition or characteristic in any supplies or services furnished by the contractor under the contract that is not in compliance with the requirements of the contract. (5:Subpart 46.701)

Second, it provides guidance as to the remedies a contracting officer may seek in the event a weapon system fails to meet the terms of its warranty. The DFARS says that a contracting officer may:

> 1. require the contractor to promptly take such corrective action as necessary (e.g., repair, replace and/or redesign) at no additional cost to the United States;
>
> 2. require the contractor to pay costs reasonably incurred by the United States in taking necessary corrective action; or,
>
> 3. equitably reduce the contract price. (5:Subpart 46.770-2(a)(2))

While warranty enforcement procedures are not expressly identified in the DFARS, the foregoing definition and the above listed remedies may provide those involved with warranty administration a starting point in initiating warranty enforcement actions and seeking contractual remedies.

The United States Air Force

As in Chapter 3, the AFFARS and AFR 800-47 are the two documents that will be reviewed for warranty enforcement coverage. The guidance provided by the AFFARS on warranty enforcement is minimal. In the AFFARS, warranty enforcement is a required topic in the warranty plan. The only other mention of warranty enforcement is at AFFARS 46.770-93(b)(2) which does not permit the requirement of additional inspections or measurements just to enforce warranty requirements.

On the other hand, Air Force Regulation 800-47 provides fairly extensive guidance relative to warranty administration in the area of warranty enforcement. Consequently, the subsequent discussion of warranty enforcement issues will focus only on the regulation's coverage of these issues.

Enforcement Responsibility. Air Force Regulation 800-47, Section A, paragraph 2(a)(4) states that one of the objectives of the WSW Program Objectives is to develop and acquire warranties that are enforceable. Another objective is to "provide standard procedures for identifying, reporting, tracking, and correcting defects and failures covered by a contractual warranty..." (7:Para 2b). To meet these objectives, the regulation provides fairly extensive and specific administrative requirements in its Attachment 4.

Warranty enforcement is the responsibility of the warranty manager. The warranty manager is tasked by the regulation to "manage and coordinate warranty application, enforcement, and administration requirements to include warranted item identification, processing, deficiency reporting, data collection, and item disposition" (7:Para 29d(2)).

Failures. Attachment 4 to AFR 800-47 addresses the requirements of WSW administration. In this section, the regulation requires program offices to develop management information systems that are able to determine whether or not EPRs are achieved and if deficiencies are corrected as required by the contract. Attachment 4 is further divided into administrative requirements for EPR warranties and administrative requirements for material and workmanship warranties and design and manufacturing warranties.

Basically for EPR warranties, a weapon system's performance is compared against that which is specified in the contract. When the actual performance is not what is contractually required, some type of remedy is usually due the

government. Based upon this identified failure, the warranty manager initiates the appropriate warranty claim action.

For warranties other than EPR warranties, a personal inspection and evaluation of the system is required. Once a failure has been identified, the regulation sets forth specific reporting requirements for the failed items. Instructions for completing particular service and deficiency reports along with references to other regulations and system unique instructions are also provided (7:Atch 4).

This information seems to provide those working with warranties in the Air Force adequate direction and guidance on both identifying failures and the procedures to follow once such failures are identified.

Remedies. In enforcing warranties, AFR 800-47 also provides adequate guidance as to what remedies should be available to the government. It requires each WSW to clearly describe the available remedies and as a minimum, provide for one or more of the following:

> 1. Require the contractor to promptly take such corrective action as necessary (e.g. repair, replace, or redesign) at no cost to the United States Government;
>
> 2. Require the contractor to pay costs reasonably incurred by the United States in taking necessary corrective action (i.e. Government repair); and,
>
> 3. Equitably reduce the contract price (e.g. may be appropriate when combat capability is not affected). (7:Para 10)

These remedies are a reiteration of the remedies set forth in DFARS 46.770-2(a)(2).

When contractor repair or replacement is the remedy under the contract, the regulation also recommends that the time the contractor has to repair or replace the item should also be stipulated.

Redesign is also mentioned in the regulation as a potential remedy. When redesign is a consideration, the circumstances requiring redesign should also be stipulated (7:Para 10).

Remedy issues are also mentioned in Attachment 3 to the regulation. This portion of the regulation however is basically a reiteration of its paragraph 10. This re-emphasis may provide added insurance that the minimum remedies required by DoD policy will be included in the WSW clause.

In summary, the Air Force regulation assigns warranty enforcement responsibility to the warranty manager, addresses the identification of failures and associated reporting requirements, and reiterates the minimum remedies as stipulated in the DFARS.

This concludes the examination of the Air Force's coverage by its regulation of the warranty enforcement issues identified in Chapter 2. The next agency to be examined is the United States Army.

The United States Army

As in Chapter 3, the Army FAR Supplement and Army Regulation 700-139 are the two Army documents that were reviewed for their coverage on warranty enforcement issues. Since the Army FAR supplement does not provide any guidance on warranty enforcement issues, the ensuing discussion will be based solely upon the guidance provided by AR 700-139.

Enforcement Responsibility. Army Regulation 700-139 does not expressly appoint a specific person or office with the responsibility of warranty enforcement. The regulation requires that the heads of major Army commands (MACOMs) "assure that warranty claim actions are filed for each failure of an item covered by a warranty" (9:Para 2-7(a)). Additionally, the heads of MACOMs

are charged by the regulation to establish a warranty control office (WARCO) at the MACOM level. Duties of the WARCOs associated with warranty enforcement include:

1. Reviewing and coordinating warranty execution procedures;

2. Developing local written instructions for warranty execution and management;

3. Execute warranties according to published procedures; and,

4. Coordinate warranty actions between the Army and the contractors. (9:Para 2-7(g))

It appears then from these assigned duties that the WARCO is primarily responsible for warranty enforcement within the Army.

Failures. The Army regulation addresses failures only from the two acquisition perspective which was previously presented in Chapter 3. These are the expected failure concept and the failure-free concept. The regulation does not provide any guidance regarding the identification, calculation, or evaluation of a warranty failure. Accordingly, for the purpose of this portion of the thesis, failures as a warranty enforcement issue are not addressed by the Army regulation.

Remedies. The regulation does not specifically reiterate the remedies available to the government that are set forth in DFARS 46.770-2. It does briefly mention reimbursements and copayments as a remedy. The regulation requires that the Army be contractually permitted to make necessary warranty repairs with the contractor required to reimburse the Army for such repairs. This remedy is also required for non-weapon system warranties (9:Para4-5).

The regulation does not mention any other remedies that should be included in their contracts or that should be sought when a contractor breaches a warranty. It does however briefly mention costs that should be recovered that

are incurred by the Army as a result of warranty administration. Such costs as additional transportation expenses, material expenses, or labor expenses are typical of those that the Army seeks reimbursement for relative to warranty administration.

The "execution" of warranties is also mentioned in AR 700-139 in paragraph 6-2. The Army Maintenance Management System (TAMMS) is referenced as providing instructions and procedures for completing warranty claim actions. It is possible that TAMMS provides additional information and guidance on warranty enforcement procedures. As this research is limited to a review of the Army FAR Supplement and AR 700-139, these maintenance procedures will not be reviewed here.

In summary, the Army regulation assigns warranty enforcement responsibility to the WARCO, does not address the identification of failures, and just briefly mentions remedies.

This concludes the examination of the Army's coverage by its regulation of the warranty enforcement issues identified in Chapter 2. The next agency to be examined is the United States Navy.

The United States Navy

As in Chapter 3, the two documents that will be reviewed for their coverage on warranty enforcement issues are the Navy FAR Supplement (NARSUP) and SECNAVINST 4330.17.

Enforcement Responsibility. This issue is not addressed in either the NARSUP or SECNAVINST 4330.17.

Failures. This issue is also not addressed in either the NARSUP or SECNAVINST 4330.17.

Remedies. Remedies are not addressed in SECNAVINST 4330.17. The NARSUP does require that warranty clauses stipulate acceptable turn around times for a contractor when initiating corrective action on a warranty claim. It also recommends that the assessment of liquidated damages be considered should the contractor fail to meet the stipulated times (10:Subpart 46.710 (g)).

The coverage of warranty enforcement issues by the Navy warranty documents can be easily summarized. No enforcement responsibility is assigned, failures are not addressed, and the coverage afforded remedies is extremely minimal.

Chapter Summary

This chapter has focused on the issues associated with warranty enforcement that were discussed in Chapter 2 and also how each of the services covered these issues in their two warranty documents. A brief summary and comparison of the agency coverage of each issue along with a review and update of the Issues Table first presented in Chapter 2 will complete this chapter.

Enforcement Responsibility. The Air Force assigns the responsibility of warranty enforcement to the warranty manager while the language in the Army regulation seems to assign this responsibility to the WARCO. The Navy regulations do not assign any particular person, office or organization with the responsibility of enforcing warranties.

Failures. The Air Force addresses failures in its regulation and describes how failures should be identified and measured. Both the Army and the Navy fail to provide specific guidance on identifying or measuring failures in their warranty documents. This issue is also not addressed in the Navy documents.

Remedies. The Air Force reiterates the DFARS in specifying the minimum remedies that should be provided under a warranty and also requires redesign to be a consideration when specifying remedies. The Army on the other hand does not reiterate the requirements of the DFARS. It does however require in its regulation that the Army is to be authorized to make warranty repairs and the contractor will reimburse the Army for these repairs. The Navy's brief coverage of remedies in its two documents is limited to the requirement of specifying turn around times when contractors are required to act on a warranty claim.

The foregoing issues are important issues that are worthy of additional attention by all three services in their warranty regulations. Both the Air Force and the Army could elaborate more on failures. The Navy needs to address all three of these issues in any forthcoming regulation that they may issue.

This summary of the services' coverage of warranty enforcement issues is depicted graphically in Table 3. This is the enforcement portion of the Issues Table first presented in Chapter 2.

This concludes the examination of the issues associated with warranty enforcement. The next chapter will examine the issues associated in evaluating warranties and how the services treat this issue in their warranty documents.

TABLE 3
SUMMARY OF ENFORCEMENT ISSUES

ISSUE ADDRESSED	USAF	ARMY	NAVY
Enforcement Issues			
Enforcement Responsibility	YES	YES	NO
Failures	YES	NO	NO
Remedies	YES	YES	NO

V. Evaluation Issues of Warranties

The previous chapter examined the issues associated with the enforcement of warranties and how each of the services covered these issues in their supplement to the FAR and their primary warranty regulation. This chapter will now examine the issues associated with the evaluation of warranties within each service.

This chapter will focus on the three issues associated with warranty evaluation that were identified in Chapter 2. These are determining the responsibility for evaluating warranties, the criteria used in warranty evaluation and if a central collection center for the warranty evaluations is required by the agency.

As in Chapters 3 and 4, the examination of the foregoing issues will incorporate the coverage that each of the services' FAR supplement and primary warranty regulation provide on this aspect of warranties. However, unlike chapters 3 and 4, the FAR and DFARS will not be addressed in this chapter as neither document contains any guidance on warranty evaluations. Accordingly, this chapter will begin by examining warranty evaluation in the United States Air Force.

The United States Air Force

The evaluation of warranties is discussed at great length in AFR 800-47. As there is no real guidance on evaluating warranties in the AFFARS, this section will focus solely on the information provided in AFR 800-47.

Evaluation Responsibility. The responsibility to evaluate warranties in the Air Force is not delegated to a particular person or position such as the warranty

manager or the program manager. Rather, this responsibility is given to an organization in the Air Force known as the Product Performance Agreement Center (PPAC). Among the many duties assigned by the regulation, the PPAC is charged with the following warranty evaluation duties:

> 1. Develop management tools, analytical techniques, and handbooks to assist program managers in selecting, evaluating, applying, and administering warranties for weapon systems, equipment, and parts;
>
> 2. Analyze the effectiveness of existing and proposed warranties and related business arrangements; and,
>
> 3. Develop improved warranties and related concepts, as well as methodologies for selecting appropriate and cost effective warranties. (7:Para 28(a)(g)(h))

The Air Force also has another organization that is responsible for taking action in the area of WSWs as a result of warranty evaluations. The WSW Management Improvement Group is responsible for implementing changes and proposed improvements in warranty policies, procedures, tools and techniques. This group is chaired by SAF/AQCS and the PPAC acts as executive secretary. The regulation requires this group to meet semi-annually or more frequently as needed (7:Para 14).

Evaluation Criteria. In evaluating warranties, the regulation requires the submission of four different reports concerning warranties. These four reports are a WSW Usage Report, a Failure Analysis Report, an Incurred Warranty Cost Report, and a Warranty Activity Report. Each report varies in its content and intended purpose and will be discussed individually.

WSW Usage Report. This report is submitted for each weapon system warranty contract. The required information that comprises the report is included as Attachment 5 to the regulation. Since this portion of the thesis deals

with evaluation criteria, its requirements are set forth here in full text. Specifically, the following information is required to be provided:

1. System nomenclature;
2. Warranty scope (system/subsystem covered by the warranty);
3. Contract Number;
4. Contractor;
5. Contract Value: (Including priced options);
6. System/Subsystem Quantity;
7. Warranty Costs: (As set forth in an applicable line item, if separately priced; or as reflected in the government price negotiation memorandum, if estimated);
8. Warranty Cost as a Percent of Contract Value;
9. Warranty Cost Cap (if any);
10. Contract Environment: (Competitive, non-competitive, etc);
11. Warranty Provision(s);
12. Warranty Coverage: (Material & Workmanship, design & manufacturing, and/or EPR); and,
13. Warranty Duration: (calendar days, operating hrs, etc). (7:Atch 5)

This report is submitted on a quarterly basis to the PPAC. The PPAC inturn provides an analysis to SAF/AQCS on such things as warranty durations, exclusions and limitations, and unique terms and conditions (7:Para 16a).

Failure Analysis Reports. These reports are submitted by the contractor for each WSW contract. They include pertinent information regarding all the items returned to the contractor for corrective action under the terms of the warranty. These reports are submitted to the management offices that have a demonstrated need for the information and to the contract administration office (7:Para 16b).

Incurred Warranty Costs Report. This is another report that is submitted by the contractor. Its purpose is to report the costs the contractor incurs as a result of the warranty. This report is submitted to the WSW manager (7: Para 16c).

Warranty Activity Report. This is an annual report that is submitted to the program manager. Its purpose is to build a performance data for each particular weapon system in order to demonstrate if warranties on future systems are advantageous or cost-effective to the government. The report must be submitted one year from the delivery of the first warranted item under the contract.

The information contained in the activity report includes but is not limited to the contractor and contract number, a summary of the claim activity during the period and cumulative claim activity, and a remarks section that allows the identification of both desirable and undesirable aspects of the warranty. Subsequent reports are required until all warranted items have been delivered and all warranty claims have been settled.

This report is provided to the program manager and is to be used when formulating WSW strategies for future acquisitions and to determine the effectiveness of the WSW. The PPAC is also to receive a copy of this report. While the regulation addresses who is to receive the report, it fails to assign specific responsibility for completing the report. The regulation merely says that these report must be accomplished by the contractor or the government (7:Para 16d).

Thus, it appears that two of the aforementioned reports, the Warranty Activity Report and the WSW Usage Report, are intended to provide a means for WSW evaluation. They are also used in determining the effectiveness of current warranties and the feasibility of future warranties.

Central Collection Center. The Air Force has a central collection center for warranty data. This is the USAF Product Performance Agreement Center (PPAC) at Wright-Patterson AFB, Ohio. In this capacity, the PPAC is charged by the regulation to:

> 1. Serve as the central data repository for warranties and related business arrangements;
>
> 2. Maintain the WSW Program repository and data base to support warranty effectiveness studies and lessons learned requirements; and,
>
> 3. Maintain a repository or locator for warranty-related software developed by the government or at government expense to manage or administer warranties. (7:Para 28)

The PPAC provides warranty users with a common place to seek assistance in acquiring and tailoring warranties for their specific purpose, help in evaluating warranties and consultation in general on warranty matters.

To briefly summarize, the Air Force assigns warranty evaluation responsibility to the PPAC, lists warranty evaluation criteria in both the body of the regulation and as an attachment to the regulation, and has the PPAC serve as its central collection activity. This concludes the examination of the Air Force's coverage on warranty evaluation. The next agency to be examined is the United States Army.

The United States Army

The Army FAR Supplement provides no guidance in the area of warranty evaluations. Accordingly, the ensuing discussion will focus on the coverage provided by AR 700-139, which is fairly extensive.

Evaluation Responsibility. As in the responsibility for the acquisition of warranties, Army Regulation 700-139 does not assign a particular person or position with this responsibility, but rather charges the Material Developer

(MATDEV) with evaluation responsibility. The MATDEV was defined in Chapter 3 as the command or agency within the Department of the Army responsible for the development or acquisition of a particular program or system. The regulation charges the MATDEVs to:

> 1. Manage, monitor, and evaluate the effectiveness of procured warranties using approved supplements to this regulation (when required); and,
>
> 2. Perform annual, inprocess and postwarranty assessments to determine effectiveness and final payoff analyses of acquired warranties. (9:Para 2-6(e),(f))

Evaluation Criteria. Warranties are evaluated in the Army at two different periods in time. These are on an inprocess basis and a final payoff basis and each use somewhat different criteria.

Inprocess Warranty Assessments. These are initially performed when the first item under warranty is delivered and then annually thereafter. The criteria used in the assessments include as a minimum:

1. Identification of the contract and the contractor;
2. A summary of claim activity during the period; and,
3. Cumulative claim activity for the contract. (9:Para 4-4 b)

Claim activity includes the claims submitted, honored, disputed, and denied and the value of each category. This assessment also covers why claims may be denied plus an analysis comparing the overall cost of the warranty to the actual benefits derived. A remarks section permits inclusion for commentaries regarding any desirable or undesirable aspects of the warranty (9:Para 4-4 b).

Final Payoff Assessment. This assessment evaluates the actual costs of the warranty relative to the costs that would have been incurred had there not been a warranty in place. It summarizes the inprocess assessment and any nonmonetary benefits that were realized as a result of the warranty. This final

payoff assessment is used to help determine the requirements for future warranties for similar systems and also the overall effectiveness of the warranty. The Army also requires an internal control checklist for warranty final payoff assessment determinations as it does for cost-effectiveness determinations (9:Para 4-4 (c)(d)).

Additionally the regulation states that "warranty information will be collected and shared by MATDEVs and gaining MACOM organizations to document and improve warranties and their benefits using a Central Collection Activity (CCA) as the combined data base" (9:Para 5-1). The regulation requires the MATDEVs to collect and provide to the CCA the following information:

1. NSN, nomenclature, and model numbers;
2. Contract number, contractor name, and Federal Supply Code of Manufacturers;
3. Warranty publications (e.g. WTB) number and date;
4. Serial, lot, or registration number range (when applicable);
5. Warranty duration (time in months);
6. Warranty usage limits (hrs/miles/km);
7. Start date of first item warranty period;
8. End date of last item warranty period;
9. Contract cost of warranty (sum and per unit) and contract item cost;
10. Subordinate (pass-through) warranties if applicable; and,
11. Special warranty provisions or conditions. (9:Para 5-1 a)

Central Collection Center. Similar to the Air Force, the Army has a central collection center for warranty information which is known as a Central Collection Activity (CCA). The Army's CCA is the USA Materiel Command, Materiel &

Readiness Support Activity located in Lexington KY. The regulation states that the CCA is to:

> 1. Collect information gathered by the MATDEVs and operate a combined data base;
>
> 2. Publish listings/reports for warranty information users; and ,
>
> 3. Provide access to the data base as an electronic mailbox for queries of individual warranty coverage specifics within 24 hours from receipt of request. (9:Para 5-2)

In what appears to be a secondary collection activity of sorts for warranty information are the MATDEVs themselves. Of additional interest is the Army's requirement for a "weapon system warranty exchange service to be provided by the legal office of the executive agent for MATDEV" (9:Para 5-3). This is to apparently promote and foster the proliferation of successful warranty clauses used throughout the MATDEV.

To briefly summarize the Army's coverage of warranty evaluation issues in its regulation, the Army assigns evaluation responsibility to the Material Developer, lists the evaluation criteria for warranties in the regulation, and has a central collection center for warranty information. This concludes the examination of the Army's coverage of warranty evaluation issues. The next agency to be examined is the United States Navy.

The United States Navy

Neither the NARSUP or SECNAVINST 4330.17 provide much guidance regarding the evaluation of warranties. SECNAVINST 4330.17 does state that it is Department of the Navy policy to ensure that systems are established for "collecting and analyzing actual warranty use and claim data" (12:Para 3b(3)). Additionally, the regulation charges the Chief of Naval Operations to:

> Develop a system for collecting actual warranty use and claim data, and for performing an analysis of the data on an annual basis with the first analysis

> to be performed on 30 June following implementation of this instruction, and annually each June thereafter. Provide copies of annual warranty data analyses to the Assistant Secretary of the Navy (Shipbuilding & Logistics) (ASN(S&L)) within 60 days of the end of the annual analysis period. (12:Para 4a(5))

However, neither the NARSUP or SECNAVINST provide further instructions on completing such evaluations or describe where any guidance could be located. Furthermore, the research thus far seems to indicate that in fact no such system currently exists in the Navy. It is possible however that the individual SYSCOMs have a tracking system or one has been developed prior to the completion of this thesis.

Evaluation Responsibility. The Navy documents do not assign a particular person, office, or organization to evaluate warranties. Broad language in the NARSUP suggests that program managers or project officers may evaluate warranties. However, no firm assignment of responsibility as in the Air Force or the Army documents is contained in the Navy documents.

Evaluation Criteria. The NARSUP requires that reports submitted by contractors be in sufficient detail to enable assessment of the overall effectiveness of the warranty (10:Subpart 46.703(c)). The following information as a minimum is required:

1. Item description;
2. Applicable contract number;
3. Contractor name and location;
4. Dollar value of the item under warranty;
5. Scope of the warranty (i.e. what is warranted, what is not) and identification of the warranty provisions (clause numbers) in the contract;
6. Warranty item repair history, including nature of repairs, cost and frequency; and,

7. Government costs chargeable to the Contractor (e.g., repair, rework, modification, reprocurement and transportation costs). (10:Subpart 42.302(a)(90)(c)(5))

This is the only mention of criteria that may be used in the evaluation of warranties.

Central Collection Center. Neither the NARSUP or SECNAVINST 4330.17 document the existence of a central collection center for warranty information in the Navy.

In summary, the Navy does not assign warranty evaluation to any particular person or office, it lists some criteria that may be used in evaluating warranties, but does not designate a central collection center for warranty information.

Chapter Summary

This chapter has focused on the issues associated with the evaluation of warranties and how the three services covered these issues in their two warranty documents. A brief summary and comparison of the agency coverage of each issue along with a review and update of the Issues Table first presented in Chapter 2 will complete this chapter.

Evaluation Responsibility. The Air Force does not assign this responsibility to a particular person or position but rather to an organization within the Air Force known as their Product Performance Agreement Center. The Army likewise appoints no particular position or person but charges the Material Developer with warranty evaluation responsibility. Language in the NARSUP implies warranty evaluation to be the responsibility of the program manager or the project officer, but no specific assignment is made in the Navy regulations.

Evaluation Criteria. Both the Air Force and the Army warranty documents enumerate the criteria that is to be used and maintained for warranty evaluation.

The information includes contract number, contractor, pertinent warranty information and similar data. The NARSUP requires similar data to be collected but the language surrounding this portion implies that it is to be used to accumulate and track data rather than as a tool for warranty evaluation.

Central Collection Center. Both the Air Force and the Army operate a central collection center for both tracking and evaluating warranties. The Navy documents do not mention the existence of a Navy collection center.

This summary of the services' coverage of warranty evaluation issues by their two warranty documents is depicted graphically in Table 4. This is the evaluation portion of the Issues Table first presented in Chapter 2.

This concludes the examination of the issues associated with the evaluation of warranties. The next chapter will provide the summary, conclusions, and recommendations of this thesis effort.

TABLE 4
SUMMARY OF EVALUATION ISSUES

ISSUE ADDRESSED	USAF	ARMY	NAVY
Evaluation Issues			
Evaluation Responsibility	YES	YES	NO
Criteria	YES	YES	NO
Central Collection Center	YES	YES	NO

VI. Summary, Conclusions, and Recommendations

The previous chapter examined the evaluation issues that were identified in Chapter 2 and how each of the services covered these issues in their supplement to the FAR and their primary warranty regulation. The purpose of this chapter is to present the summary, conclusions, and recommendations of this thesis effort. Also presented are some recommendations for future research efforts.

The summary will be an overview of the issues discussed and will be accompanied by a brief synopsis of the coverage provided by the three services in their warranty documents. The conclusions arrived at are a result of the examination, analysis, and comparison of the services' coverage of the issues. The recommendations will include suggested improvements in the warranty documents and some recommendations for future research efforts.

Summary

The requirements of 10 U.S.C. 2403 for obtaining warranties on weapon systems purchased by the Department of Defense have resulted in the three services facing a variety of issues associated with weapon system warranties. Chapter 1 of this thesis briefly provided some background information on warranties in the DoD and addressed warranties in general. Chapter 2 reviewed the issues associated with weapon system warranties. These issues were divided into three aspects. They were acquisition aspects, enforcement aspects, and evaluation aspects. Chapters 3, 4, and 5 discussed each of these aspects, their related issues, and how each of the three services addressed these issues in their supplement to the FAR and their primary warranty regulation. The following discussion will summarize each of these three aspects for each service.

When referring to the coverage of each issue, the service itself will be referenced rather than its specific warranty document.

The United States Air Force. The two Air Force documents reviewed were the Air Force FAR Supplement (AFFARS) and AFR 800-47. The issues addressed by these two documents and the coverage they provide of the issues are summarized in Table 5. This is a summary of all seventeen issues discussed throughout this thesis, with an indication as to the Air Force's coverage of each.

TABLE 5
SUMMARY OF AIR FORCE COVERAGE
OF THE WARRANTY ISSUES

ASPECTS	USAF
Acquisition Issues	
Buying Responsibility	YES
Reasons for Buying	YES
Cost-Benefit Analysis	YES
Waiver Procedures	YES
Prices	YES
Coverage	YES
Duration	YES
Identification	YES
Failures & Remedies	YES
Exclusions	YES
Funding	NO
Enforcement Issues	
Enforcement Responsibility	YES
Failures	YES
Remedies	YES
Evaluation Issues	
Evaluation Responsibility	YES
Criteria	YES
Central Collection Center	YES

Acquisition Issues. The Air Force advocates the use of a team approach when buying warranties. It apparently purchases warranties for both the assurance and insurance benefits they provide. A cost-benefit analysis is required to insure that only cost-effective warranties are purchased. If warranties are determined to not be cost effective, the Air Force has outlined procedures that supplement those contained in the DFARS for requesting a waiver.

The guidance provided on the important issue of pricing warranties is minimal. For negotiated procurements, it appears that the burden of substantiating costs associated with the warranty is placed on the contractor. Otherwise, the guidance provided is of little assistance in this area. The extent of warranty coverage is also brief. This is probably because the regulation is focused on weapon system warranties. Accordingly (although not investigated in this thesis) coverage at a lower level may be addressed elsewhere. The issues of both durations and markings are well covered by the Air Force. Failures and remedies are mentioned as are examples of exclusions that should be considered. The only issue identified in Chapter 2 that is not covered by the Air Force is funding considerations.

Enforcement Issues. The warranty manager is charged with the responsibility of enforcing warranties. For EPR warranties, failures are identified by comparing actual field performance data with the requirements that were originally specified. For other than EPR warranties, actual visual verifications are required. The possible remedies mentioned by the Air Force are the same as those listed in the DFARS. Additionally, redesign is mentioned as a possible remedy.

Evaluation Issues. All of the evaluation issues are addressed by the Air Force. The Air Force Product Performance Agreement Center is tasked by the

regulation with evaluating existing and proposed warranties. The evaluation criteria that is used in warranty evaluations is clearly set forth in the regulation and is sent to the Air Force's central collection center which is also the Product Performance Agreement Center.

Every issue except that of funding is addressed in some manner by the Air Force. While the coverage varies from minimal to thorough, it forms a beginning for dealing with the issues associated with weapon system warranties.

The United States Army. The two Army documents reviewed were the Army FAR Supplement and AR 700-139. The issues addressed by these two documents and the coverage they provide of the of the issues is presented in Table 6. This is a summary of all seventeen issues discussed throughout this thesis, with an indication as to the Army's coverage of each one.

TABLE 6
SUMMARY OF ARMY COVERAGE
OF THE WARRANTY ISSUES

ASPECTS	ARMY
Acquisition Issues	
Buying Responsibility	YES
Reasons for Buying	YES
Cost-Benefit Analysis	YES
Waiver Procedures	YES
Prices	YES
Coverage	YES
Duration	YES
Identification	YES
Failures & Remedies	NO
Exclusions	NO
Funding	NO
Enforcement Issues	
Enforcement Responsibility	YES
Failures	NO
Remedies	YES
Evaluation Issues	
Evaluation Responsibility	YES
Criteria	YES
Central Collection Center	YES

Acquisition Issues. Unlike the Air Force, the Army does not specifically assign the responsibility of warranty acquisition to a particular person or organization. This overall responsibility is however assigned to the MATDEV, which is the command within the Army responsible for the acquisition of a particular program or system. Whether or not the MATDEV uses a team approach is not expressed in the two documents reviewed. However, like the Air Force, the Army also buys warranties for both their assurance and insurance benefits. A cost-benefit analysis also is required by the Army in determining the proposed cost-effectiveness of warranties. Additionally supplemental waiver procedures to those contained in the DFARS are stipulated.

The issue of pricing is likewise virtually ignored by the Army. Without guidance in this important area, warranty users are left with general rule-of-thumb techniques that may or may not be accurate and in the best interests of the government. The Army does specify what the various candidates are for warranty coverage with the regulation. Durations of warranties as well as the marking of warranties is well covered by the Army. The last three acquisition issues of failures and remedies, exclusions, and funding are not covered by the Army.

Enforcement Issues. The WARCO appears to be assigned the responsibility of enforcing warranties in the Army. However, the identification, evaluation, or measurement of warranty failures is not stipulated by the Army. Remedies are mentioned, but only briefly. One remedy required by the Army in addition to those in the DFARS is the requirement that allows the Army to make necessary warranty repairs and charge the costs of such repairs to the contractor.

Evaluation Issues. As with acquiring warranties, the responsibility for evaluating warranties rests with the Material Developer. Warranties are evaluated on both an inprocess and final payoff basis, with the criteria used in both assessments set forth in the regulation. Similar to the Air Force, the Army maintains a central collection center for warranty related data.

The majority of the issues identified and discussed in Chapter 2 are addressed in some manner by the Army. As with the Air Force, the extent of the Army's coverage also ranges from minimal to thorough.

The United States Navy. The two Navy documents reviewed were the Navy FAR Supplement and SECNAVINST 4330.17. The issues addressed by these two documents and the coverage they provide are summarized in Table 7. This is a summary of all seventeen issues discussed throughout this thesis, with an indication as to the Navy's coverage of each one.

TABLE 7
SUMMARY OF NAVY COVERAGE
OF THE WARRANTY ISSUES

ASPECTS	NAVY
Acquisition Issues	
Buying Responsibility	NO
Reasons for Buying	YES
Cost-Benefit Analysis	YES
Waiver Procedures	NO
Prices	NO
Coverage	YES
Duration	YES
Identification	YES
Failures & Remedies	NO
Exclusions	NO
Funding	NO
Enforcement Issues	
Enforcement Responsibility	NO
Failures	NO
Remedies	NO
Evaluation Issues	
Evaluation Responsibility	NO
Criteria	NO
Central Collection Center	NO

Acquisition Issues. The Navy does not expressly assign the responsibility of warranty acquisition in the two documents reviewed. They do however appear to buy warranties for the same two reasons as the Army and the Air Force, which is to realize both their insurance and assurance benefits. Although the requirement for a cost-benefit analysis is mentioned in the NARSUP, its coverage is brief and lacks specific details, directions, or supplemental information as to where additional guidance in this area could be obtained. Supplemental procedures for obtaining waivers were not found in either Navy document nor was any information regarding the pricing of warranties. Warranty coverage is another issue that is not mentioned by the Navy.

Two acquisition issues that are addressed by the Navy include warranty durations and warranty markings. However, the last three issues of failures and remedies, exclusions, and funding are also missing in the Navy documents.

Enforcement Issues. The three issues of enforcement responsibility, failures, and remedies associated with warranties are not addressed by the Navy. While the Navy does require that turn around times for contractor repairs of warranty items be stipulated, this scant coverage barely qualifies as addressing the issue of remedies.

Evaluation Issues. Broad language in the NARSUP suggests that the program manager is responsible for evaluating warranties. In order to evaluate warranties, the Navy does require that specific information be submitted by contractors. However, where this information is sent or collected is not clear as the Navy has not designated a central collection center for warranty related data and information.

This summary of the services' coverage of warranty issues is depicted graphically by Table 5. This is the Issues Table first presented in Chapter 2, now updated to include all of the issues for each aspect of weapon system warranties.

TABLE 8
SUMMARY OF WARRANTY ISSUES

ASPECTS	USAF	ARMY	NAVY
Acquisition Issues			
Buying Responsibility	YES	YES	NO
Reasons for Buying	YES	YES	YES
Cost-Benefit Analysis	YES	YES	YES
Waiver Procedures	YES	YES	NO
Prices	YES	YES	NO
Coverage	YES	YES	YES
Duration	YES	YES	YES
Identification	YES	YES	YES
Failures & Remedies	YES	NO	NO
Exclusions	YES	NO	NO
Funding	NO	NO	NO
Enforcement Issues			
Enforcement Responsibility	YES	YES	NO
Failures	YES	NO	NO
Remedies	YES	YES	NO
Evaluation Issues			
Evaluation Responsibility	YES	YES	NO
Criteria	YES	YES	NO
Central Collection Center	YES	YES	NO

Conclusions

The United States Air Force. The Air Force provides the most extensive guidance on the issues associated with weapon system warranties. Its regulation is extensive and its supplement to the FAR is also the most extensive and explicit of the three services. However, there are several issues that need

additional emphasis and areas that supplemental guidance would improve the existing Air Force documents. These will be addressed in the recommendations section of this thesis.

The United States Army. The Army has had warranty guidance in the field in the form of a regulation longer than any of the other two services. AR 700-139 is dated 10 March 1986 and it superseded AR 702-13 entitled "Army Warranty Program" which was dated 1 January 1981. Its current regulation is similar to the Air Force regulation in that it addresses the majority of the issues associated with weapon system warranties. Those issues not addressed could be easily covered in a change or a supplement to the existing regulation. As it is, AR 700-139 provides those working with warranties a good foundation to understand and deal with warranty issues.

The United States Navy. The Navy's warranty guidance in the two documents reviewed barely addresses the issues associated with weapon system warranties. Broad and unrestrictive directives may allow the Navy's SYSCOMs the flexibility to tailor their specific warranty requirements. However, this also has the potential to promote inconsistency in both acquiring and administering weapon system warranties. The lack of a uniform and comprehensive directive also has the potential to create confusion at the user level plus result in duplicating efforts at various levels. This duplication of efforts has the compounding potential problem of wasting scarce resources, both personnel and funding resources.

Compared to the Air Force and Army regulations, the Navy's guidance is inadequate. It fails to address the majority of the issues associated with warranties. The issues that are addressed are either barely mentioned or lack any real substantive guidance.

Recommendations

The United States Air Force. The Air Force documents are the most comprehensive of the three services' documents reviewed. The areas where improvements appear necessary are concentrated in the acquisition aspect of weapon system warranties.

First and most importantly, additional guidance is necessary in the area of warranty pricing. According to the records extracted from the PPAC's computerized data base, from 1 January 1985 through 30 April 1988, the Air Force has spent 1.56 billion dollars on weapon system warranties. Accordingly, comprehensive guidelines in pricing warranties would help to ensure that these dollars are being spent as efficiently and effectively as possible. Either revisions to AFR 800-47 or supplemental warranty pricing procedures would assist in this area.

Second, AFR 800-47 should be amended to require that completed cost-benefit analyses be included in the contract file and a copy forwarded to the PPAC. This would help to ensure that accurate and complete CBAs are being completed and that only cost effective warranties are being acquired. Completed CBAs received by the PPAC could be reviewed and evaluated for thoroughness and completeness with the ones that employ the best procedures and techniques being shared with others faced with completing CBAs.

Finally, streamlining and providing standardized procedures for requesting waivers may preclude warranties from being obtained when in fact they are not cost-effective. If the waiver request procedures are viewed as either too involved or unlikely to result in approval, waivers may not be initiated. Instead, warranties

may be acquired that are not cost-effective and that should not be purchased. Improved procedures may preclude this.

The United States Army. The proposed recommendations for improvement to the Army documents are similar to those advanced for the Air Force.

First, as in the Air Force, the Army needs to improve and strengthen it guidance on warranty pricing. The Army spends a considerable amount of money for its warranties. From the late fiscal year 1986 through the first quarter of fiscal year 1988, the Army spent approximately 65.5 million dollars on warranties (13). Accordingly, supplemental guidelines and procedures on pricing of warranties would help to ensure the price paid for the warranty is indeed fair and reasonable.

Additional guidance appears necessary regarding the issues of failures, remedies and exclusions. While these issues may very well be addressed in other Army documents such as maintenance manuals or technical bulletins, the Army is not thorough in these areas in its warranty regulation. Including additional guidance in these areas would enhance the Army's already comprehensive and thorough document.

Additionally, the Army may also want to consider the possibility of providing streamlined and standardized procedures for requesting waivers. This may prevent warranties from being obtained when they are not cost-effective because the waiver procedures are viewed as either too complex or unlikely to result in a waiver being approved.

Finally, the Army may want to consider advocating the team approach when acquiring warranties. While the MATDEVs are charged with acquiring warranties and their locally developed procedures may in fact advocate this, support at the Army level for this approach through its regulation may reinforce this idea.

The United States Navy. The Navy's warranty documents are the least comprehensive and have the most room for improvement. The individual SYSCOMs probably do have unique requirements that mandate some degree of flexibility in being able to tailor their warranty requirements. However, there are many issues that are not unique to the SYSCOMs and the lack of a comprehensive Navy warranty document that addresses these and SYSCOM unique issues provides those working with warranties no guidance in dealing with these issues.

Accordingly, the first recommendation to be advanced is that the Navy should issue a comprehensive and thorough regulation on warranties. The regulation should address the issues associated with warranties and provide instructions and guidance on dealing with these issues. The Navy could learn a great deal by examining the regulations issued by the Air Force and the Army in composing their regulation. For example, the Army regulation provides a thorough methodology for calculating durations and its procedures for marking warranted items is exhaustive. Similar procedures could be adopted by the Navy.

Also, the Navy should establish a central collection center similar to the USAF PPAC for its warranty information and data. This would eliminate the duplication of efforts throughout the Navy by having one organization that could assist others in formulating warranty clauses, completing CBAs, and evaluating current and proposed warranties.

Finally, a management information system should be developed that allows warranty information to be tracked and evaluated within the Navy. Currently, no such system seems to exist.

Recommendations For Future Research

This thesis effort uncovered several other areas that would warrant additional research. They include the following.

First, since the effects of the new warranty law are just beginning to be felt, individuals within an agency who actually purchase, enforce, and evaluate warranties should be surveyed to determine the actual effectiveness of the agency's regulation in its coverage of warranty issues. In practice, are the policies and procedures set forth by the regulations effective in dealing with the problems and issues of warranties? New regulations that are proposed for implementation are usually circulated for comments prior to actual implementation. However, now that the users have had a chance to work with warranties more in depth, new issues or variations of previous issues may now be more apparent that may or may not be addressed in the regulation. A survey conducted as part of continued warranty research may help in surfacing some of these issues and help to strengthen and enhance the current regulations.

Second, the various cost-benefit models employed by the services could be examined in detail and a comparison done between them. Proposing a hypothetical warranty with specific requirements and using each service's model to determine its cost-effectiveness may produce interesting results. Would the cost-effectiveness of the proposed warranty be the same or similar using the different CBA approaches of the Army compared to those of the Air Force? This may allow the identification of desirable and undesirable elements of each, with the results possibly used in formulating a model that incorporates the best elements of those examined.

Also, research into actual or pending litigation as a result of warranties should be accomplished. The reasons why litigation resulted due to the warranty could be determined and if regulatory revisions would preclude future disputes.

Finally, research on warranty prices and pricing procedures should be accomplished. Warranties cost the DoD millions of dollars annually. The development of sound pricing procedures and accurate cost estimating techniques would go a long way in ensuring that the warranties purchased by the DoD are truly fair and reasonable.

Appendix: List of Acronyms

AFAR	Army FAR Supplement
AFFARS	Air Force FAR Supplement
AFR	Air Force Regulation
AR	Army Regulation
CBA	Cost-Benefit Analysis
CCA	Central Collection Activity
C-E	Cost Effectiveness
CNO	Chief of Naval Operations
DFARS	DoD FAR Supplement
DoD	Department of Defense
DSMC	Defense Systems Management College
EPR	Essential Performance Requirement
FAR	Federal Acquisition Regulation
MACOM	Major Army Command
MATDEV	Material Developer
NARSUP	Navy Acquisition Regulations Supplement
PM	Program Manager
PPAC	Product Performance Agreement Center
SECNAVINST	Secretary of the Navy Instruction
SYSCOM	Systems Command
TAMMS	The Army Maintenance Management System
WARCO	Warranty Control Office/Officer
WSW	Weapon System Warranty

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Warranties are required by law to be obtained on all weapon systems purchased by the Department of Defense. As a result, the three services within the DoD must face a variety of issues associated with weapon system warranties. This thesis examines the issues associated with the acquisition, enforcement, and subsequent evaluation of warranties. It then examines how each of the three services treat these issues in their supplement to the Federal Acquisition Regulation and in their primary warranty regulation.

Prior to examining the foregoing issues, the thesis begins by first reviewing the background of warranties and discussing some theoretical considerations. The issues themselves are then presented followed by their treatment by the DoD. After the examination of the issues and their treatment by the DoD, recommendations are made for suggested improvements to the services' regulations. This thesis is useful in that it identifies several areas that should be addressed by the military departments in their warranty guidance in their warranty guidance. It also advances recommendations for improvements to the regulations.